

## Durham E-Theses

---

### *The relationship between work measurement and management accounting in small businesses*

W. G Kirkwood

#### How to cite:

---

Kirkwood, W. G (1978) The relationship between work measurement and management accounting in small businesses. Masters thesis, Durham University.

#### Use policy

---

The full-text may be used and/or reproduced, and given to third parties in any format or medium, without prior permission or charge, for personal research or study, educational, or not-for-profit purposes provided that:

- a full bibliographic reference is made to the original source
- a <https://etheses.durham.ac.uk/id/eprint/9991/> is made to the metadata record in Durham E-Theses
- the full-text is not changed in any way

The full-text must not be sold in any format or medium without the formal permission of the copyright holders.

Please consult the [full Durham E-Theses policy](#) for further details.

THE RELATIONSHIP BETWEEN WORK  
MEASUREMENT AND MANAGEMENT  
ACCOUNTING IN SMALL BUSINESSES

A thesis submitted for the degree of

Master of Arts

in the

University of Durham

Following research conducted in

Durham University Business School

of the

Faculty of Social Science

By

WILLIAM GERALD KIRKWOOD

1978

TABLE OF CONTENTS

	Page No.
TITLE PAGE	1
TABLE OF CONTENTS	2
LIST OF DIAGRAMS AND TABLES	9
DECLARATION OF ORIGIN	11
STATEMENT OF COPYRIGHT	11
ABSTRACT	12
ACKNOWLEDGEMENTS	13
PREFACE	14
CHAPTER I: ORIGINS AND DEVELOPMENT OF THE RESEARCH	20
1.1    Origins of the Research	20
1.2    The Systems Theory Approach	23
1.3    Empirical Inter-relation and Use of Techniques	26
1.4    Theoretical Generalisations of Inter-relation of Management Techniques	27
1.5    Initial Assumptions, Aims and Hypothesis	33
1.6    Relationship with Other Research	34
1.7    Summary	38
CHAPTER II: MANAGEMENT ACCOUNTING AND ITS LINKS WITH WORK MEASUREMENT	40
2.1    Review	40
2.2    Budgetary Control	42
2.3    Standard Costing	45
2.4    Properties of Management Accounting Systems	47
2.5    Measurement	50

	Page No.
2.6 Accuracy	51
2.7 Comparability	57
2.8 Objectivity	61
2.9 Management Accounting and the Small Business	67
2.10 Summary	70
CHAPTER III: WORK MEASUREMENT AND ITS CONTRIBUTION TO MANAGEMENT ACCOUNTING	71
3.0 Work Measurement and Management Accounting	71
3.1 Historical	73
3.2 Contemporary Work Measurement and Management Accounting	76
3.3 Element Division and Recording	76
3.4 Timing Methods	80
3.5 Rating	86
3.6 Methods of Rating	88
3.6.1 Speed or Performance Rating	88
3.6.2 Synthetic Rating	90
3.6.3 Objective Rating	91
3.7 The Contribution and Criticism of Rating	92
3.8 Allowances	96
3.9 Predetermined Motion Time Systems	104
3.10 Standard Data	113
3.11 Summary	114

	Page No.
CHAPTER IV: WORK MEASUREMENT IN PRACTICE	115
4.0 Work Measurement Practice and its Contribution to Management Accounting	115
4.1 Systems	116
4.2 Rating	117
4.3 Allowances	118
4.4 Practitioner Training and Selection	119
4.5 Recruitment Parameters	121
4.6 Work Measurement Experience	122
4.7 Work Measurement in the Small Business Unit	124
4.8 Summary and Conclusions	126
CHAPTER V: RESEARCH DESIGN AND TESTING	128
5.1 Nature of the Research	128
5.2 Testing	130
5.3 Measurement and Design	131
5.4 Variance Control	131
5.5 Validity	132
5.6 Reliability	133
5.7 Hypotheses	134
5.8 Summary of Constructs and Variables	136
5.9 Sample Groups and Comparability	140
5.10 Small Business Units in the Furniture and Timber Industry as a Survey Area	145
5.11 Interview Schedules	148
5.12 Summary	152

	Page No.
CHAPTER VI: RESEARCH CONSTRUCTS AND VARIABLES	153
6.1 The Use of Management Accounting Information	153
6.2 Use of Work Measurement - Non Use of Work Measurement	156
6.3.1 Use of Work Measurement - Independent Experimental Variable	158
6.3.2 Use of Work Measurement - Moderator Variable	160
6.4.1 Non Use of Work Measurement - Independent Experimental Variable	165
6.4.2 Non Use of Work Measurement - Moderator Variable	166
6.5 Small Business Profile	167
6.6 Perceived Usefulness of Management Accounting Information	169
6.6.1 Accuracy	173
6.6.2 Comparability	176
6.6.3 Objectivity	176
6.7 Management Accounting System and Environment	179
6.7.1 Management Accounting Function	180
6.7.2 Organisational Environment of Management Accounting	189
6.7.3 Budget Standards	191
6.7.4 Participation	193
6.7.5 Superior Subordinate Relationships	197
6.7.6 Perceived Usefulness on Raw Materials Issue	203
6.8 Summary	206

	Page No.
CHAPTER VII: SURVEY RESPONSE AND GENERATION OF USE/NON USE GROUPS	207
7.1 Response	207
7.2 Derivation of Groups	213
7.3 Independent Variable - Use of Management Accounting Information System	216
7.4 Independent and Moderator Variable - Use of Work Measurement	219
7.5 Independent and Moderator Variable - Non Use of Work Measurement	224
7.6 Independent Variable - Small Business Profile	229
7.7 Summary	237
CHAPTER VIII: DECISION MAKERS PERCEPTION OF THE ACCOUNTING INFORMATION	238
8.1 Dependent Variables - Findings	238
8.1.1 Accuracy	239
8.1.2 Comparability	249
8.1.3 Objectivity	253
8.1.4 Usefulness of Information - Open Comment	256
8.2 Discussion of Dependent Variable Findings	258
8.2.1 Accuracy	258
8.2.2 Comparability	261
8.2.3 Objectivity	264
8.3 Effects of Moderator Variables on Dependent Variables	266
8.4 Conclusions	268
8.5 Summary	269

	Page No.
CHAPTER IX: THE ENVIRONMENT OF THE MANAGEMENT ACCOUNTING INFORMATION	272
9.0 Effects of Extraneous Variables	272
9.1 Management Accounting Function	273
9.2 Budget Standards	277
9.3 Participation	278
9.4 Superior Subordinate Relationships	280
9.4.1 Frequency of Personal Communications	280
9.4.2 Performance Appraisal	281
9.4.3 Frequency of Group Discussion	282
9.5 Perceived Usefulness of Information on Raw Materials Issue	284
9.6 Management Accounting System and Environment - Conclusions	286
9.7 Summary	288
CHAPTER X: ACCOUNTANTS PERCEPTION OF ACCOUNTING INFORMATION	289
10.1 Basis and Objectives of Analysis	289
10.2 Methodology	290
10.3 Dependent Variables - Findings	291
10.3.1 Accuracy	291
10.3.2 Comparability	292
10.3.3 Objectivity	293
10.3.4 Usefulness	294
10.4 Dependent Variables - Discussion and Conclusion	296
10.5 Summary	299

	<u>Page No.</u>
CHAPTER XI: SUMMARY AND CONCLUSIONS	300
11.1 Origins and Objectives	300
11.2 Management Accounting and Work Measurement	301
11.3 Research Design and Testing	303
11.4 Generation of Use and Non Use Groups by the Survey	306
11.5 Decision Makers Perception of Accounting Information	307
11.6 Accountants Perception of Accounting Information	309
11.7 Conclusions	311
APPENDIX A: THE QUESTIONNAIRE	
A.1 Measurement Quality and Pretesting	312
A.2 Planned Application of the Questionnaire	313
A.3 Interview Schedule and Questionnaire	319
APPENDIX B: REVIEW OF SUPPLEMENTARY DATA AND IMPLICATIONS OF THE RESEARCH FOR INTERESTED PARTIES	348
B.1 Some Practical Consequences for Small Businesses	348
B.2 Management Techniques in Small Firms	353
B.3 Some Comparative Views of Work Measurement Criteria	356
B.4 Levels of Accuracy in Management Accounting and Work Measurement	358
B.5 Outputs from this Interdisciplinary Research	360
B.6 Summary of Implications and Supplementary Findings	361
BIBLIOGRAPHY	364

LIST OF DIAGRAMS AND TABLES

		<u>Page No.</u>
Fig. 1	Research Structure	137
Table 1	Potential Links Between Properties of Work Measurement and Management Accounting.	72
Table 2	The Measurement and Coding of Properties of Perceived Usefulness of Management Accounting Information	178
Table 3	The Measurement, Coding and Properties of the Management Accounting System and Environment	201
Table 4	Reponse Rate by Areas	209
Table 5	Response Rate by Type of Business	211
Table 6	Independent Variable Groups	214
Table 7	Distribution of Exclusion Criteria	214
Table 8	Comparison of Products and Production Modes Between Use and Non Use Groups	231
Table 9	Differences in Percentages Between Over/Under Assessments of Labour Activity	242
Table 10	Proximity Scores of Decision Makers	244
Table 11	Variation Scores of Decision Makers	246
Table 12	Job Comparability Scores of Decision Makers	250
Table 13	Time Comparability Scores of Decision Makers	252
Table 14	Objectivity Scores of Decision Makers	255
Table 15	Management Accounting Function Scores of Use and Non Use Groups	275
Table 16	Timeliness Relevance and Understandability Scores of Use and Non Use Groups	275
Table 17	Budget Standards Scores of Decision Makers	278
Table 18	Participation Index - Scores of Use and Non Use Groups	279
Table 19	Frequency of Communication Index Scores of Use and Non Use Groups	281
Table 20	Group Discussion of Budgets Frequency and Usefulness Index Scores of Use and Non Use Groups	283

	<u>Page No.</u>
Table 21 Perceived Usefulness of Information on Raw Materials Scores of Use and Non Use Groups	285
Table 22 Indices of Usefulness Scores of Accountants as Use and Non Use Groups	294

None of the material offered has previously been submitted by the candidate for a degree in the University of Durham or any other university and is not based on joint research but is the sole work of the candidate.

"The copyright of this thesis rests with the author. No quotation from it should be published without his prior written consent and information derived from it should be acknowledged."

ABSTRACT

The research starts from the general premise that small firms could benefit from greater combined use of management techniques. Through analyses of the general concepts of two such techniques, management accounting and work measurement, theoretical links based on their various properties are established between them and their relevance to small businesses is assessed.

The testing of a hypothesised relationship between the use of work measurement and beneficial output of management accounting information is carried out in small business units of the furniture and timber industry in the North of England. Measures are designed and applied to generate two sample groups of firms which are similar in their use of management accounting but are dichotomous in either using or not using work measurement. Differences between how useful the accounting information on direct labour activity is perceived by managers and supervisors from the two groups are measured. An assessment is made of whether this difference is associated mainly with the use of work measurement, or is influenced by the accounting system itself or by the behavioural aspects of the environment in which it operates.

The results show clearly that in the cases researched, the management accounting information is perceived as being more useful by decision makers when it is based on the use of work measurement. Similar perceptions about the usefulness of information are held by accountants.

Guide lines are suggested to aid small businesses in general who are not in the furniture and timber industry to assess the relevance of the research results to themselves.

ACKNOWLEDGEMENTS

My thanks are due primarily to Allan Gibb, my Supervisor for his patient guidance on the project. His suggestions concerning the methodology of the survey and the opening of an access door to the Furniture and Timber Industry were particularly helpful. Above all, his meticulous and incisive criticism of my sometimes less than literate outputs throughout the entire research programme was of inestimable value.

I am grateful also to the Furniture and Timber Industry Training Board and its Officers who provided me with listings of small firms. The survey of course, was only possible through the co-operation of those small firms that I visited and through the many people within them who made themselves available for interview.

To Pat Veal and Jean Seargeant who worked many long unsocial hours under difficulties in typing the thesis, I extend my sincere thanks for executing a task of such high quality.

Finally, I applaud my wife and family who have borne with me over a much protracted period and for recognising that time estimates may sometimes be multiplied by a factor of four.

PREFACE

This thesis is submitted to the Faculty of Social Science of the University of Durham for the award of the M.A. degree. It presents a review and discussion of research undertaken into the relationship between work measurement and management accounting within the context of small firms.

The initial broad objectives of the research were to investigate the likely effects of the use of the management technique of work measurement on two significant aspects of the control of small businesses, management accounting and production control. These were later rationalised, in the light of constraints, to those of assessing the relationship of the use of work measurement to the usefulness of management accounting as viewed by decision makers and also by accountants. One practical outcome of this might be that small businesses could be helped to arrive at a decision of whether or not to make use of the technique of work measurement.

The thesis starts by describing in Chapter 1 the origins and development of the research idea and its relationship with other research. The authors experience in various ways with the small business field are referred to as initiating factors together with the stimulus of the Bolton report. The influence of the systems concept is described as leading to an examination of the links both theoretical and empirical between work measurement and other sub-systems of the business rather than research into detailed subdivisions of the technique itself.

A preliminary hypothesis is formulated around which a research programme could be designed to test the nature of the relationship between work measurement and management accounting. The relationship of this research with other research on work measurement and also on management accounting is discussed.

From a basis of the stated purpose of management accounting and the decision areas where it has relevance, Chapter II identifies and discusses those particular features and properties of management accounting which have a theoretical link with work measurement. The concept of accounting measurement is examined and the links between such properties as accuracy comparability and objectivity and work measurement, are traced. The question is then pursued as to the extent to which these generalisations about management accounting and its links with work measurement are applicable to small businesses.

Chapter III examines what authoritative writers in the field consider to be the substantive theoretical knowledge of work measurement, and critically modifies this by incorporating the results of a number of researchers in the field. The purpose of this examination is to search for the origins and enquire into the validity of the link elements of work measurement such as, timing methods and rating, which were postulated in Chapter II as being linked with management accounting properties of accuracy, comparability and objectivity. As a result of this examination, these latter properties are seen to be supported by valid properties of work measurement theory to an extent which indicates theoretically a positive relationship between work measurement and the usefulness of management accounting systems. Chapter IV looks at work measurement

in practice to check for the presence of these link elements and to search for others which may be there in practice but are not yet presented in the general theory. The applicability of work measurement to small businesses is also considered at this stage.

Research design both from a general but relevant view, and as a particular approach and structure in this research, is dealt with in Chapters V and VI. Firstly, the nature of the research being undertaken is clarified and the concepts of testing, measurement, and variance control are considered. Using these concepts and the earlier theoretical analysis, hypotheses are formulated linking the use of work measurement with the usefulness of management accounting information to decision makers and accountants. As a means of testing the hypotheses, a number of constructs and variables are proposed and set in a structural framework, a feature of which is the generation of two sample groups of small business units who are dichotomous in their "Use" or "Non Use" of work measurement but who are all from a common industrial segment, that of the Furniture and Timber Industry. Interview schedules are then selected as the means of data collection from these two groups. In Chapter VI each of the constructs is examined and developed to one or more measurable variables which are then operationally defined and transposed into specific items on the questionnaire schedule, Appendix A, as measuring instruments. At this stage the internal functioning of the accounting system and such behavioural aspects as participation and leadership patterns are developed as variables which might have some influence within the research design.

The presentation of the results and analysis of the survey starts in Chapter VII with sections on the nature of response from the Furniture and Timber Industry, and on the derivation of two sample groups from this response as a result of applying the key experimental variables. The data collected on these variables, Use of Management Accounting Information, Use of Work Measurement and Non Use of Work Measurement, is presented and discussed. This is followed by an analysis of the data on the variable Small Business Profile, which identified the industrial characteristics of the two derived groups.

Chapter VIII is concerned with the other key pivot of the research design, the survey results of the decision makers perception of accounting information. There is a presentation, analysis and discussion, of the survey data measuring the dependent variable Perceived Usefulness of Management Accounting Information by decision makers under the headings of Accuracy, Comparability, Objectivity and Usefulness. A further dimension of analysis is pursued in an intra group examination of the effects of moderator variables associated with the Use or Non Use of work measurement and as a result the hypothesis is substantiated at this stage of analysis. The further validation of the hypothesis proceeds in Chapter IX with an analysis of the survey data on the extraneous variables, Management Accounting Function, Budget Standards, Participation and Superior Subordinate Relationships. This is to check whether there are any inter group differences which might affect the dependent variables. The survey data on the Perceived Usefulness of Management Accounting Information on Raw Materials Issue is then analysed to assess the effect of any such differences - an analysis which leads to the final validation of the hypothesis.

Chapter X first suggests why delineation of any differences between perceptions of accountants and decision makers could be useful and then explains how such an investigation was carried out. Results from the research survey are presented and analysed and these show first of all that there is a positive relationship between the use of work measurement and the perceived usefulness of management accounting information by accountants. Comparison with the perceptions of decision makers is made to bring out any differences between these perceptions and those of the accountants.

Chapter XI summarises the research thesis through the various stages leading to the conclusions on the testing of the hypotheses.

Appendix A sets out the questionnaire schedule in full with an indication of how the questionnaire was planned to be administered to enhance the quality of measurement. The analysis of and findings from supplementary information are set out in Appendix B together with implications from the whole project for various interested parties.

## CHAPTER 1

### ORIGINS AND DEVELOPMENT OF THE RESEARCH

#### 1.1 Origins of the Research

The origin of this research can be traced to a number of complimentary influences on the author in terms of experience, particular job assignments, environmental factors and chosen interests. For many years the author's only contact with the world of small business was as a user of their services whilst carrying out managerial tasks in a large industrial company. However, more recent experience as a management teacher at Teesside Polytechnic has involved the supervision of projects carried out by students in the Diploma in Management Studies and the Diploma in Works Management. Mainly as a result of a developing relationship between the Polytechnic and small businesses, in which the Industrial Liaison centre played a significant part, many of these student projects were carried out in small or medium sized businesses.

A management development programme aimed at local businesses resulted in intensive dialogue with owners, managers and foremen of small businesses, both in the classroom setting and in the work place itself. The author's close association with the Teesside Small Business Club since its inception created further awareness of the problems and reality of small business management. A strongly emerging feature of these experiences was the absence within small businesses of many management concepts and techniques in the fields of Accounting, Marketing, Operations Management, Organisation and Human Behaviour. There was however, active discussion about the extent to which small businesses could gain in effectiveness from the adoption of these concepts and techniques.

The author's earlier experience in a large industrial company was that the main difference between a costing system or a production control system for an 800 man unit as against a 2000 man unit, given similarity of manufacturing technology, was one of scale of resource input such as data processing time, amount of computer time or numbers of analysts or decision makers. However, with a small business it seemed to be more a question of whether the step up to a formalised system of costing and production planning, from a possible current method based on scraps of loose paper or the mental recall of the manager or foreman, should be made at all. Constantly the question had to be considered of the gain in effectiveness that would accrue not merely in comparison with the cost of the scheme but against the degree of availability within the business of the necessary time skills and motivation to operate the scheme. There was a need to guard against proposing schemes and techniques that may have in theory yielded considerable benefit but which were too detailed or complex to be operated by the human resources available. On the other hand where a level of system or a particular technique could be pitched within the resource scope of the business the net gain in effectiveness appeared to be considerable. Thus the interest of the author was aroused towards a search for generalisations about the use of management techniques in small businesses of similar size having similar technologies and within such industries as hotel and catering or steel fabrication.

Parallel with the influences already referred to was the publication of the Bolton Report (1) which aroused national interest and discussion about small firms and which in relevant sections correlated strongly

(1) Bolton J.E. Report of the Committee of Inquiry on Small Firms - London H.M.S.O. 1971

with the author's experience, thus providing encouragement to this research. In its review of management skills and advisory services the Bolton Report (2) considers all those services aimed at assisting the manager in the more efficient administration and running of his business. It comments on the constraint that size represents on the limitations of managerial skill and on absence of management qualifications (and by implication management training). Whilst acknowledging that the running of a small business on a basis of the manager's experience and commonsense may be effective whilst the firm's activities remain static and relatively free of crisis, the report suggests that significant growth or the need to react to dramatic changes in the environment will reveal shortcomings in managerial ability or resource.

The report goes on to comment that the responses arising from their investigations with financial institutions and specialist centres for small business study indicate, that the belief that the general level of management in small firms is low is quite widely held. This is a consistent belief applying to most areas or functions of management - it is a belief that small businessmen could improve their performance in:- finance; costing and control information; organisation; marketing; information use and retrieval; personnel management; technological change; production scheduling and material control. These areas of potential improvement in the main, coincide with those already referred to as having been casually identified by the author. The report acknowledges that it would be wrong to suggest that such deficiencies are confined to small firms and that small businessmen in general would not accept that they are less efficient than big industry but makes the point that small firms could be more efficient by making

(2) Ibid Chapter 10

greater use of systems and by placing less emphasis on instinctive elements when running their businesses. Bolton (3) quotes a comment from The Merseyside Productivity Association:

"A lot of owner managers are afraid of systematic management. One reason for this is the fear that the techniques will usurp their authority and decision making role."

and goes on to comment that small firms are bound to be less efficient than they could be whilst these attitudes persist.

These various influences then, compounded to arouse the interest of the author into investigating systematically just how useful management techniques were in reality to pragmatically minded small businessmen, bearing in mind their apparent rejection of change in their way of management unless they could see clear evidence of increase in effectiveness without threat to themselves. These influences were very strongly reinforced by the stimulus of conclusion 19-21 of the Bolton Report (4):

"We trust that this Report will generate further interest in the sector not only in Government and among trade associations and others directly concerned with small business, but also among academics.....  
The field offers enormous scope for further research: our own work and that of our commissioned researchers has suggested many avenues that could be fruitfully pursued and which lack of time alone has prevented us from attempting."

## 1.2 The Systems Theory Approach

Which particular technique then, would be the basis for investigation in the small business sector? Some of the author's earlier experience, firstly in developing techniques by way of designing production control

(3) Ibid Page 114

(4) Ibid Page 353

systems, or implementing work study, and then in managing a manufacturing department, suggested that whilst one technique such as production scheduling, or stock control, or close cost control, might appear to dominate the management process at any one time or in a particular setting, the various techniques and functions were highly inter-dependent. Budgetary control was linked with recording and processing of information; production planning was dependent on market forecasting; customer satisfaction was related to production control, which in turn was dependent on personnel or behavioural management. Effective management seemed to arise from ensuring that the whole enterprise worked as a balanced inter-linked system rather than over-concentration on a supposedly critical area such as labour relations, or work in progress stocks.

This earlier experience of the totality of the management process was expanded and viewed with additional perspective by exposure to readings on the systems approach to organisation and management by such authors as Kaste & Rosenzweig (5), Katz & Kahn (6), Boulding (7), von Bertalanffy (8) and Timms & Pohlen (9).

- (5) Fremonte E. Kast and James E. Rosenzweig. Organization and Management A Systems Approach. McGraw-Hill Inc. New York 1970
- (6) Daniel Katz and Robert L. Kahn. The Social Psychology of Organizations. John Wiley & Sons Inc. New York 1966
- (7) Kenneth E. Boulding "General Systems Theory: The Skelton of Science" Management Science. Vol.2 No.3 April 1956 Pages 197-208
- (8) Ludwig von Bertalanffy "The Theory of Open Systems in Physics and Biology" in F.E. Emery (ed) Systems Thinking. Penguin Books England 1969
- (9) Howard L. Timms and Michael F. Pohlen The Production Function in Business Decision Systems for Production and Operations Management. Richard D. Irwin Inc. Homewood Ill. 1970

The concern with totality and interconnection is supported by Kast & Rosenzweig (10) in their definition of a system as:

"An organized unitary whole composed of two or more inter-dependent parts components or subsystems and delineated by identifiable boundaries from its environmental supratsystem."

and who suggest the system approach as a means of exploring management by analysis of inter-relationships among subsystems as well as interactions between the subsystem and its supra system. Kenneth Bouldings (11) classification of systems which sets forth a heirarchy of levels, from the anatomy of the universe down to the cell and back to social systems, has been transposed by Timms and Pohlen (12) to the production function in business when they refer to an heirarchy of problems in management in which each system in the heirarchy is a subsystem of a higher order system and may contain within it other subsystems which are inter-related. This extension was of considerable importance to the author in supporting the idea that the inter-relationship between parts of a system was not merely a concept applicable to large organisations but was equally viable at a lesser level of size and thus within the context of a small firm or manufacturing unit. In their discussion on systems theory within the manufacturing function Timms and Pohlen (13) classify three subsystems: the functional subsystem (production); the information subsystem; and the decision subsystem, and indicate that the flow of information is first from the functional system, is marshalled by the information system, passed to the decision system and thence back to the functional

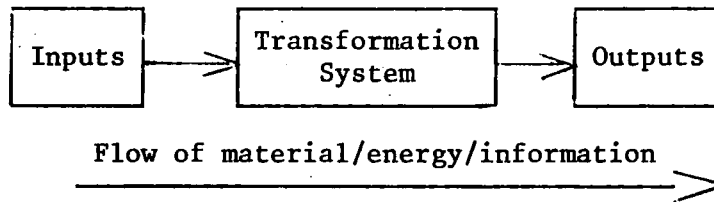
(10) Kast and Rosenzweig op cit Page 20

(11) Boulding op cit Pages 197-208

(12) Timms and Pohlen op cit Page 102

(13) Ibid Pages 108/109

system for action. Kast and Rosenzweig (14) have a general model of organization as an open system in terms of :



Marshalling of information, the decision process, functional action are all examples of transformation systems with the outputs of one system forming the inputs of the other related system.

### 1.3 Empirical Inter-relation and use of Techniques

This combination of earlier practical management experience, followed by the exposure to a theoretical framework consequent upon teaching, focussed interest on the way techniques and functions are inter-related, rather than on a technique or part of a technique itself. An informal review of the small firm sector by the author suggested that whilst small or medium sized businesses were inclined to accept the desirability of splitting the macro system of annual financial accounts into micro sub systems in terms of monthly management accounts they were less inclined to use more systematic means of measurement in deriving some of the related input into the management accounting subsystems. Likewise the production control subsystems appeared to lack accurately measured inputs. Many firms not having a management accounting system, realized that their control was less effective than it might be; on the other hand those using management accounting found it helpful. Firms in both these categories however, showed little concern about their non use of work measurement and seemed quite satisfied with their existing informal means of assessing work tasks. On the other hand those few small organisations that had

implemented work measurement found themselves equipped with a much more sensitive and discriminatory system of management accounting to assist in controlling their operations. Some degree of similarity of this situation to the situation on the national scale can be inferred from part of the Bolton Report (15). Although cost control is included in the list of particular weaknesses of small firms, nevertheless accountants and bank managers are reported as prominent in the sources the small businessman turns to for help and advice, with consultants on the other hand being mistrusted as a source of help. The acceptance of management accounting and relative absence of consultancy derived work measurement is not therefore surprising.

From this combination of experience, exposure and review, the research theme began to gell around the use of and inter-relationship between the subsystems of work measurement, production control, and management accounting.

#### 1.4 Theoretical Generalisations of Inter-relation of Management Techniques

In addition to matching systems theory to practical experience, what theoretical generalisations are made by specialists in the field about the way in which work measurement is related to management accounting and production control? Benjamin Niebel (16) refers to time study as a "requisite" for standard cost methods and as a "basis" for budgetary control and illustrates how accurate control and determination of labour costs with reliable time standards contributes to

(15) J.E. Bolton op cit Pages 113 and 116

(16) Benjamin W. Niebel. Motion and Time Study, Richard D. Irwin Inc. Homewood Ill 1972. Pages 580/581

management decisions about cost reduction or price revision. An International Labour Office (17) publication refers to work measurement as providing basic information for setting standards of labour costs and the means of controlling them and that such standards:

"Provide certain of the information necessary for the production and indirect expense budgets and, related to the sales budget, indicate the plant and labour capacity likely to be available over the period of the budget."

After stressing the need for accurate standards, the authors comment that incomplete cost information "is at the root of much bad management." Whilst pointing out that labour cost control is only one of the many factors that management has to control to be successful Michael Avery (18) states that time values are a useful contribution to the budget process. "Their main value is that they can be an accurate source of the basic data upon which much of the cost allocations depend." C.F. Graham (19) lists several labour cost items which management requires, including standards, variances, historical job costs, and says that a good system of cost control which will satisfy these requirements will be based on the work measurement unit of a standard minute. Virgil H. Rotroff (20) in assessing what work measurement means to the accountancy function of a business, refers to measured time standards as providing the basis for establishing standard costs with the assurance to management of accuracy and reliability and concludes:

- (17) International Labour Office Introduction to Work Study  
I.L.O. Geneva 1964 Page 284
- (18) Michael Avery. Time Study Incentives and Budgetary Control.  
Business Publications Ltd. London 1964. Page 242
- (19) C.F. Graham. Work Measurement and Cost Control. Pergamon  
Press, Oxford 1965. Page 151
- (20) Virgil H. Rotroff. Work Measurement. Reinhold Publishing  
Corporation, New York 1959. Page 13

"Undoubtedly the major value of work measurement to the company comptroller is the availability of accurate, reliable standards for costing and accounting purposes, enabling him to prepare reports to management for planning and controlling company policies and operations intelligently."

Charles T. Horngren (21) refers to standard costs as the building blocks of a budgeting and feedback system and that the job of setting a labour cost standard is a complicated task usually carried out by trained and experienced industrial engineers using time study techniques. G.H. Hofstede (22) refers to the stress placed by accounting text books on the need to use all available technical efficiency standards when composing budgets although he found that people in the factory considered technical and budget standards to be quite different things. Having reported that "scientifically" set technical standards may lack accuracy, he nevertheless goes on to say:

"For a complete budget system there should be co-operation between technical standard setting engineers and budget accountants."

In referring to the development of standards for the control of prime cost, R.M. Lynch (23) asks who sets standards. His view is that labour quantity standards are most useful when they are the result of sound engineering time studies; these require considerable skill and judgement by the engineer, and that although the results are not as precise as design engineering information, nevertheless industrial engineering analysis provides one of the best bases for setting labour standards.

- (21) Charles T. Horngren. Cost Accounting, a Managerial Emphasis. Prentice-Hall International Inc. London 1972. Pages 186, 203
- (22) G.H. Hofstede. The Game of Budget Control. Tavistock Publications Ltd. London 1968. Pages 27, 242.
- (23) R.M. Lynch. Accounting for Management. McGraw Hill Book Company, New York 1967. Pages 180, 181

The relationship between work measurement and production control is referred to by the International Labour Office (24) publication in the section on Programme Planning and the Utilisation of Plant and Labour. From the time studied basis of the length of each operation and using a figure of average performance rating, production requirements can be matched against capacity. This matching can be used to forecast bottlenecks in production, show up excess capacity and can provide accurate estimates of delivery dates. Benjamin Niebel (25) illustrates how machine, department, and plant capacity are determined by the medium of time standards and goes on to show how time study is valuable in balancing the work force with the available volume of work.

Commenting on improving production control he says:

" No matter what the degree of refinement in the scheduling procedure it would be utterly impossible without time standards. The success of any schedule is in direct relation to the accuracy of the time values used in determining the schedule. If time standards do not exist, schedules formulated only on the basis of judgement cannot be expected to be reliable."

Work measurement, according to Virgil H. Rotroff (26) provides the source of most of the information required for realistic and attainable schedules which themselves are the keystone around which successful production control is built. Work standards represent the only reasonably accurate measure whereby the required work load can be matched with capacity in advance of production and he comments that:

" The use of inadequate information at the planning stage can only produce an unrealistic and unattainable schedule"

According to Martin V. Starr (27) the labour input is a significant dimension for determination of optimal scheduling strategies and goes

(24) International Labour Office op cit Pages 282, 283

(25) Benjamin W. Niebel op cit Pages 575 to 580

(26) Virgil H. Rotroff op cit Pages 15, 16 and 140/141

(27) Martin K. Starr. Production Management Systems and Synthesis Prentice Hall Inc. Englewood Cliffs N.J. 1965. Pages 336/337

on to suggest time studies as a means of determining how long it takes to do a job. Robert A. Olsen (28) refers to the need to establish standard times as one of the requirements for effective work scheduling and of the importance of various work study models to ascertain these. Powell Niland (29) describes the need for some way to measure both the capacity and work required as fundamental to any system of production planning and scheduling, and that a crude way of doing this is by the monetary value (on a cost basis) of the goods produced. In spite of its drawbacks, if fairly large samples of orders are dealt with at any one review and the objective is long run aggregate scheduling, then the monetary value might be satisfactory. Measurement of capacity by man (or machine) hours, however, is theoretically the best type of measuring device for planning and scheduling with time study carried out by a competent man being the most accurate. He goes on to suggest that the lower accurate assessments made by estimators might well be tolerable if there is sufficient aggregation involved for the random errors to balance one another out. In their section on the calculation of capacity, R.N. Van Hees and W. Monhemius (30) point out the necessity to know the total amount of work involved per unit of product. Although social developments have tended to reduce the significance of the relationship between performance and earnings, they suggest that work measurement:

"Originally used merely for the purpose of calculating norms and calculating wages..... will continue to play an important part as one of the starting points for the calculations of capacity."

- (28) Robert A. Olsen. Manufacturing Management A Quantitative Approach. Intermation Text Book Co. Pennsylvania 1968. Page 404 and Chapter 12
- (29) Powell Niland. Production Planning Scheduling and Inventory Control. A Text and Cases. The Macmillan Co. Toronto 1970 Pages 58/60
- (30) R.N. Van Hees & W. Monhemius. Production and Inventory Control Theory and Practice. The Macmillan Press Ltd. London 1972

Surveying the work of standard texts referred to it would appear that most writers on "Work Study" (a classification which includes the American "Motion and Time Study") in their generalisations about the use of work measurement, consistently include management accounting and production control as areas of the management process to which the management science, work measurement, contributes significantly. However, from the user view point in the field of production planning and control, apart from those already quoted, there are many writers who make little or no reference to the derivation of capacity or of work content per unit output, or little reference to work measurements part in any derivation when they are discussing strategies and models for planning and scheduling.

Thus although there has been some more recent generalisation as exemplified in Niland (31) and Van hees & Monhemious (32) which have identified those parts of a production control system which might benefit from an input of work measurement, the relatively lesser stage of development of generalised theoretical knowledge about production control inputs in comparison with management accounting, suggests that it might be desirable for more particular investigations into the nature and role of inputs into production control systems to be carried out before any attempt is made to hypothesise the relationship between production control and work measurement in small businesses. On the other hand writers of management accounting texts, in expressing a user view point, are in the main consistent in their reference to the importance of work measurement as one of the crucial inputs to the management accounting system. It seems

(31) Powell Niland op cit

(32) R.N. van Hees & W.Monheimus op cit

therefore worthwhile to proceed with an investigation into the relationship between work measurement and management accounting but not for the time being with the link with production control.

### 1.5 Initial Assumptions, Aims and Hypothesis

The concluding assumptions derived from sections 1.1 to 1.4 may be summarised as follows:-

- (a) The area of small businesses is a fertile and accessible sector for research.
- (b) There is a stronger interest by the small business sector in the use of management accounting than in the use of other management techniques.
- (c) The limited and casual empirical evidence collected by the researcher suggests there is a positive relationship between work measurement and the management control of small businesses.
- (d) The systems theory concept of inter-relationship between sub-systems encourages the investigation of multidisciplinary aspects of management techniques in small businesses.
- (e) Generalisations about the inter-relation between management accounting and work measurement are more consistent than the evidence about the link between production control and work measurement.

As a consequence of these clarified assumptions, the original research idea was refined into the formulation of the aim that the research would seek to analyse the degree and level of complexity of work measurement used in small businesses in relation to its influence on the effectiveness of management accounting techniques such as budgetary control and standard costing.

As a guide to the design of a research programme that would test the foregoing ideas and relationships and achieve the aims of the research, a preliminary hypothesis was formulated:-

"In order to derive full advantage from the application of budgetary control and costing systems, small business units need to increase the sophistication of their methods of measuring production."

An alternative to the theorised relation between work measurement and management accounting, however, is that small businesses are using parameters or methods which may be regarded as valid substitutes for formal measurement in controlling effectively the manufacturing function of their businesses. It might well be that the open systems characteristic of equifinality as identified by von Bertalanffy (33) applies in that the same final result or state, viz. - effective control of the small manufacturing unit - can be achieved in different ways. The different ways such as the manager's personal experience of work tasks or simple models based on average historical data, may be a valid substitute for work measurement as a basis for inputs to management accounting. Hence one practical outcome of the research activity might be that by identifying the contribution made to management control by work measurement, some degree of assistance might be provided to the problem faced by small businesses in the decision of whether or not and to what extent small businesses should invest in the resource of work measurement.

#### 1.6 Relationship with Other Research

Much research in the field of work measurement is concerned with analysis of component parts of the work measurement system. The work of T.U. Mathew, D.J. Desmond and L.J. Anson in 1950 published

by Desmond (34) in 1962 and that of B. Moore (35) are examples of research into the accuracy and effectiveness of rating whilst the effect of pacing on worker performance has been researched by N.A. Dudley (36), A.M. Hagan (37) and K.F.H. Murrell and Bel Forsaith (38). In addition to the early work of physiologists and others as reported by N.A. Dudley (39) and R.M. Belbin (40) research about compensating rest allowances has been carried out by K.F.H. Murrell (41) and the Unit for Research in Human Performance at Cardiff.

The research of the author is not concerned with sub parts of the work measurement system but with usage of the system and the relationship of the net output of the system with other parts of the management process, and as such it has more in common with the work quoted below.

- (34) D.J. Desmond The 1950 National Survey of Work Measurement, Work Study and Industrial Engineering Pages 323-331, Pages 369-377, 1962
- (35) B. Moores Variability in Concept of Standard in the Performance Rating Process. International Journal Production Research Vol. 10 Pages 167-173, 1972
- (36) N.A. Dudley The Effect of Pacing on Worker Performance. International Journal Production Research Vol 12 Page 60, 1962
- (37) A.M. Hagan Comparative Study of Paced and Unpaced Performance. Unpublished Ph.D Thesis, University of Birmingham 1962
- (38) K.F.H. Murrell, Bel Forsaith Laboratory Studies of Repetitive Work II; Results from Two Subjects. International Journal Production Research Vol. 2, 4, Pages 247-264
- (39) N.A. Dudley, Work Measurement: Some Research Studies. Macmillan 1968 Chapter 4
- (40) R.M. Belbin Compensating Rest Allowances: Some Findings and Implications for Management Arising from Recent Research, College of Aeronautics, Cranfield Note No. 54 - 1956
- (41) K.F.H. Murrell, Fatigue Measurement, Continued Learning and Rating Capability - Report of a Research Conference 1971. Department of Applied Psychology U.W.I.S.T Cardiff

F.M. Bevis and P.I. Collier (42) surveyed the use of work measurement in companies of all sizes in Wales. K. Swann (43) included work measurement as one of the management techniques whose usage he surveyed in small businesses in Yorkshire and has correlated business success with the combined use of method study work measurement and management accounting. R.G. Norman and S. Bahiri (44) developed an adaptation of work measurement in order to carry out a more accurate assessment of productivity in the West Midlands whereas the contribution by work measurement to a particular aspect of management control, incentive payment has been critically reviewed and developed by William G. Allan (45) and is being further researched by G.S. Smith (46). R.G. Norman and S. Bahiri (47) commenting on their approach in writing about their work on productivity measurement, indicate their desire to appeal to the production engineer, accountant and economist:

"..... because it is these professions that need to show more co-ordination and innovation by improving management information systems that will provide adequate criteria on which manufacturing decisions can be made."

The research being reported in this thesis is also, to a great extent exploring this interface between production engineering management accounting, and line management. As such it has some similarity with

- (42) F.W. Bevis and P.I. Collier. An Industrial Survey of Work Study in Wales 1963-1965. An unpublished paper, Welsh College of Advanced Technology.
- (43) K. Swann Management Attitudes and Techniques in the Small Company. Unpublished Thesis, University of Bradford 1971
- (44) R.G. Norman & S. Bahiri Productivity Measurement and Incentives Butterworths, London 1972
- (45) William G. Allan Work Study and Worker Remuneration. Unpublished MSc Thesis, University of Strathclyde 1970
- (46) G.S. Smith Measurement of Labour Productivity. Unpublished paper at Work Measurement Research Seminar, University of Birmingham, Department of Engineering Production, April 1975
- (47) R.G. Norman and S. Bahiri op cit preface

Hoefstede's work (48) in five different industrial settings in Holland where by exploration from the management practices side and by testing he was establishing the relationship between such variables as budget attitude, participation in standard setting and management information and accounting techniques. Anthony Hopwoods (49) work in the manufacturing division of a large American company was also carried out amongst factory managers and supervisors in order to study the effects of the different ways of using accounting information in performance evaluation. Another investigation into the interface between management accounting and decision making was carried out in the steel industry in Great Britain by Hilal (50) who surveyed, across a broad field, a number of influences in the management accounting system particularly as they affected foremen and junior supervisors.

The author's research from an accounting viewpoint would be classified by R.K. Mautz (51) under the collection of data category and is not concerned with analysis and classification of data as exemplified by Russell M. Barefields (52) laboratory study of an internal system of summarization or condensation of data from multiple sources. Nor is the research concerned with fresh approaches to internal concepts such as the use of set algebra by Richard Mattessick (53) to

- (48) G.H. Hofstede The Game of Budget Control, Tavistock, London 1968 Pages 104-110
- (49) Anthony G. Hopwood An Accounting System and Managerial Behaviour Saxon House, England 1973. Page 34
- (50) I.M. Hilal The Factors Affecting Cost Control By Shop Floor Management In The British Iron & Steel Industry. Unpublished PhD Thesis, Manchester University 1967. Pages 3 & 4
- (51) R.K. Mautz The Role of the American Accounting Association in Accounting Research. Research in Accounting Measurement Ed Robert K. Jeedicke, American Accounting Assoc. 1966 Page 2
- (52) Russel M. Barefield The Effect of Aggregation on Decision Making Success: A Laboratory Study, Journal of Accounting Research Vol 10 No.2, Autumn 1972 Pages 229-242
- (53) Richard Mattessich Accounting & Analytical Methods Richard D. Irwin, Homewood Ill 1964.

reformulate foundations of accounting nor with evaluation of model building as in the analysis of existing and developing forms of depreciation method by W.H. Beaver and R.E. Dukes (54).

Following this examination of relationship with other research it may be said that the research of the author seems to be placed in the field of inter-disciplinary studies carried out in industrial organisations.

### 1.7 Summary

This chapter has traced the origins of this research to experience of the author in carrying out, within the field of small businesses, consultancy, management development and the supervision of management student projects. In addition to this experience there was some stimulus from the Bolton Report particularly in the direction of the use of management techniques by small businesses. Acquaintance with the systems theory approach and its relevance to the totality of the management process suggested an inter-disciplinary approach in terms of the relationship between techniques rather than the investigation of a technique in itself and this was reinforced by the practical experience which had indicated that whereas small firms were beginning to make use of management accounting and production control techniques, they were less inclined to use work measurement as an input into these systems. The theoretical generalisations of inter-relation of these techniques were briefly reviewed and it was concluded that there was sufficient evidence to proceed with an

(53) Richard Mattessich Accounting and Analytical Methods  
Richard D. Irwin, Homewood Ill 1964

(54) W.H. Beaver and R.E. Dukes. Depreciation Methods, Some  
Analytical Results. Journal of Accounting Research  
Vol. 12 No.2 Autumn 1974 Pages 205-215

examination of the relationship between work measurement and management accounting but not between work measurement and production control. Aims and assumptions for this examination were clarified and a preliminary hypothesis was formulated linking beneficial outputs from management accounting with inputs from work measurement and around which a research programme could be designed to test the relationship. Finally the relationship of this research to other research was sketched out and this work was seen to be placed in the field of inter-disciplinary studies carried out in industrial organisations.

CHAPTER IIMANAGEMENT ACCOUNTING AND ITS LINKS WITH WORK MEASUREMENT2.1 Review

The first step in developing a research programme to examine the interface and test the relationship between management accounting and work measurement is to examine the generalised theory of management accounting and search within it for theoretical links with work measurement.

In distinguishing between financial accounting and management accounting, Charles T. Horngren (1) suggests that whilst the former is mainly concerned with the historical and stewardship aspects of external reporting to shareholders, government and other interested parties, management accounting has an emphasis towards:

1. Internal reporting to managers for use in planning and controlling routine operations
2. Internal reporting to managers for use in making non-routine decisions and in formulating major plans and policies

He indicates that the role is fundamentally one of providing information for various decision needs ranging from management of recurring operations to strategic decisions and policy making. Robert N. Anthony (2) suggests that whereas the governing objective of financial accounting, provision of information or stewardship to outsiders, can be met by a single set of principles and a single system, management accounting is a more fluid concept. As the governing

(1) Charles T. Horngren. Cost Accounting: A Managerial Emphasis Prentice Hall International Inc. London 1972 Pages 3, 4

(2) Robert N. Anthony, Management Accounting Richard D. Irwin, Homewood Ill 1970. Pages 351, 352

objective of management accounting is "to furnish information that is useful to management" it has a multi-purpose role assisting with such activities as planning, the measuring and appraising of performance, analysing alternative courses of action, and in fulfilment of this role information may need to be put together in different ways.

In similar vein, having reviewed several different definitions of management accounting, R.I. Tricker (3) produces the following definition which he admits gives management accounting very wide terms of reference:

"Management accounting is the application of accounting knowledge for the purpose of organising selecting, compiling and presenting accounting, quantitative and statistical information derived from all the relevant records of a business to assist those responsible for management in controlling the business and in the making of day to day decisions and in the formulation of policy."

In addition to emphasising the provision of management information which should be useful over the range from "small managerial decision making" to long term strategy, he suggests:

"This information is not limited to that contained in the traditional accountancy records but covers all quantified data, in whatever units it is expressed and, from whatever source it is derived."

R.M. Lynch (4), Charles T. Horngren (5), Gordon & Shillinglaw (6) and Fertig, Istvan & Mottice (7) all emphasise that one of the most

- (3) R.I. Tricker *The Accountant in Management*. B.T. Batsford, London 1967 Page 49
- (4) R.M. Lynch *Accounting for Management: Planning and Control* McGraw-Hill Inc. New York 1967. Pages 5 & 12
- (5) Charles T. Horngren *op cit* Pages 3-14
- (6) Myron J. Gordon, Gordon Shillinglaw *Accounting: A Management Approach*. Richard D. Irwin Inc. Homewood Ill 3rd Ed. 1964. Pages 529, 530, 537, 545-548
- (7) Paul E. Fertig, Donald F. Istvan, Homer J. Mottice. *Using Accounting Information*. Harcourt Brace Jovanovich, New York 2nd Ed. 1971

important functions in management is the decision making process. The decision making process being one of choosing between specific alternatives with respect to one problem in the company's operations. Which products should we produce? What production schedules should we set? What method should we use? On which work centre? Which people should we praise, chastise, retrain? What plant or equipment should we buy? In the determination of data needed at various levels of decision making Horngren (8) quotes the work of a research team as identifying three types of data:

- "1. Scorecard questions: Am I doing well or badly? An evaluation of performance.
2. Attention directing questions: What problems should I look into? The focus on operating problems, imperfections, inefficiencies and opportunities. These data enable managers to act effectively in important aspects of operations by planning and by astute day to day supervision.
3. Problem-solving questions: Of the several ways of doing the job, which is the best? This involves concise qualification of the relative merits of different courses of action and is more associated with non-recurring decisions."

The indication from these various writers is that the better the information supplied the better the choice between alternatives is likely to be. Management therefore, seeks constantly for the best available information concerning goals and alternative actions and management accounting's role is to gather the information and organise it into meaningful categories for use by managers.

## 2.2 Budgetary Control

Referring to the use of accounting information, Gary Luoma (9) states:

(8) Charles T. Horngren op cit Page 8

(9) Gary A. Luoma Accounting Information in Managerial Decision Making for Small & Medium Manufacturers - Research Monograph 2 National Association of Accountants 1967. Page 39

"In budgetary control, accounting is beneficial initially in helping management to identify trouble spots through actual budgeted comparisons and variance analysis."

The budget system produces a comparison between desired result and actual result in order to indicate those areas where action can be concentrated where it is most effective. Using actual-budgeted comparison and variance analysis management is assisted in identifying problem areas where decision making needs to be applied. Variance is not merely separated into labour, materials and expenses but is broken down into responsibility centres (which may be product based as well as function based) and direct and indirect cost.

Lynch (10) comments that for cost control to be effective it must be tied into a system of reporting performance which is both accurate and fair and in suggesting responsibility accounting as a means to this end, quotes John A. Higgins (11)

"This new approach to accounting and reporting is the development of an accounting system designed to control expenditure by directly relating the reporting of expenditures to the individuals in the company who are responsible for their control."

Charles Horngren (12) in defining responsibility accounting, profitability accounting or activity accounting, states that these systems:

"..... recognize various decision centres throughout an organisation and trace costs (and revenue, assets and liabilities where pertinent) to the individual managers who are primarily responsible for making decisions about the cases in question."

- (10) Lynch R.M. Accounting for Management. McGraw Hill 1967 Page 242
- (11) Higgins John A. Responsibility Accounting. The Arthur Anderson Chronicle. April 1952 Vol. 12 No. 2
- (12) Charles T. Horngren Cost Accounting A Managerial Emphasis Prentice Hall International Inc. London 1972, Page 158

He gives an illustration of responsibility accounting in relation to the organisation of a company, and demonstrates performance reports appropriate to three management levels: the supervisor of a machining department; the vice president of production; the president of the company.

In order to produce a statement of labour cost in relation to desired output of volume, the budget system uses data which itself has been derived from some form of measure. According to Lynch (13) the accounting system will collect and process the data but the information on which budgeted costs are based will be found in sources outside the accounting department. For example, quantities of materials or service items such as steam, will be calculated by the engineering or technical sub-system, prices for materials and purchased parts will be derived by the purchasing department. Similarly the human and machine work required for a desired result or desired output needs to be summated from measurement of discrete elements of the task in much the same way as the anticipated total of materials and purchased parts is built up.

Comparable with the means used for materials, Lynch (14) suggests that information about the quantity of work required is most useful if it is derived as a result of sound engineering studies carried out by industrial engineers. Whether by these means or by some form of estimation by the supervisor it would appear that the accounting system itself has the necessary skills to assemble the data into

(13) R.M. Lynch op cit Page 181

(14) Ibid Page 181

useful information for the decision maker but does not normally apply actual measures to create the data on which its output information is based.

This view ignores the scope and opportunity the accounting system has to use its resources and skills in extracting from its historical records measures or parameters for assessing budgeted costs. The use of such skills and resources however, is to introduce possible degrees of variance from expected cost levels which would not qualify the information stating these anticipated levels, as being useful in terms of being specific and accurate. Such variances in historical records might arise from two sources. The first source of variance is that historical records tend to be a single statement or mean arising from aggregation which gives little indication of the range of work load for different units of product, nor little indication of the nature of the distribution of work loads per unit of product over the different types or sizes of a product. The second source of variance from realistically attainable results is the possible inaccuracy in the booking or recording of work time in relation to units produced which may be done deliberately by individual operations to smooth out high and low outputs in a given time period such as a week. Such manipulation is known in practice by accountants and is colloquially referred to as "work in hand" or at "the back of the book".

### 2.3 Standard Costing

Associated with the budget function of controlling period activities is the concept of standard costing, the technique concerned with the setting up of standard costs and an analysis of the differences between standard and actual costs. Looking again at historical

records of costs and the purpose of such records, their purpose may be viewed as providing cost information as a factor in determining net income for a period, or for product costing or pricing. However, historical costs have somewhat of a limited value for controlling costs as Charles Horngren states (15):

"Many people are inclined to regard historical costs as 'actual' costs even though the accounting measures of costs are permeated by many assumptions including the ubiquitous average."

Although the use of refinements such as regression analysis may improve the usefulness of historical costing he goes on to suggest that a normative approach should be taken, that is a determination of what costs should be, rather than what they have been. Management requires to know how much a job should cost. Management requires cost standards to act as a rule of measurement so that it can assign responsibility for actual results knowing that those results were measured accurately.

The development of standards can be a large and detailed task depending on the size of the company or business segment and the complexity or diversity of product. Lynch (16) refers to the standard cost for a unit of completed product as being put together somewhat in the same way as the physical product is assembled, namely in detail according to its constituent elements and in sequence according to the flow of operations:

"Each molecule of material and labour cost in a unit of cost is made up of atoms of quantity and rate (or price)."

In the case of labour this is the labour time required for producing

(15) Charles T. Horngren op cit 806

(16) R.M. Lynch op cit Pages 179, 180

the goods and the rate at which this time is valued. According to Parker (17) these labour times can be derived from analysing cost records but this is a relatively unscientific way and fraught with dangers such as not taking into account the effort put in by operatives:

"Unless this is reasonably consistent from task to task and department to department, then the exercise is hardly worth doing."

Lynch (18) refers to the need to use time study to determine how much production can be achieved by the average operator working under normal conditions at a motivated pace taking into account such factors as set up times, fatigue, breakdown and other delays.

#### 2.4 Properties of Management Accounting Systems.

Given the assumption that the management accounting system is that portion of the total information system of a business which is concerned with collecting, processing and presenting monetary and none monetary quantitative data for the purpose of providing information for decision makers within an organisation, this section identifies further the characteristics of management accounting systems in order to distinguish those criteria of internal information systems which are thought to be beneficial to decision making.

This identification of properties of internal information systems enables those properties of work measurement which are important to these properties to be identified for subsequent analysis, and clarifies a number of information systems variables which could

(17) V. Parker. Costing in the furniture industry. Pergamon Press 1965. Page 67

(18) R.M. Lynch op cit Pages 179, 180

be measured in comparison with work measurement variables.

In discussing the characteristics of information for a control system, James C. Emery (19) suggests there are several different dimensions to the characterisation which include, response time, accuracy, reliability, generality as well as volume. Richard Mattessich (20) and Gordon Shillinglaw (21) both refer to time-lines, objectivity or impartiality, consistency, relevance and comparability as characteristics to be looked for in an accounting information system.

The Committee (22), consisting mainly of academics in accountancy, charged by the American Accounting Association with identifying criteria for choosing between different internal accounting information systems, reviewed various previous studies and identified four separate activities that together, constitute an internal account information system viz:-

Problem Specification

Measurement

Transmission

Response

- (19) James C. Emery. Organizational Planning and Control Systems Theory and Technology. Macmillan London 1969. Pages 98-101
- (20) Richard Mattessich "Methodological Preconditions and Problems of a General Theory of Accounting". The Accounting Review July 1972
- (21) Myron J. Gordon, Gordon Shillinglaw op cit Pages 15-18
- (22) Report of the Committee on Concepts and Standards of Internal Planning and Control. American Accounting Association. The Accounting Review October 1974

They comment on the difficulty of prediction of incremental systems benefits of different accounting information systems to decision makers within an organisation, and turn away from the development of prediction methodology. Instead, the various properties of these separate activities of information systems or of the information provided by such systems have been identified on the grounds that benefits are achievable only to the extent that these properties are present. Commenting on laboratory research on the effect of alternative accounting techniques, T.A. Lee (23) suggests that:

"at the present time it is unreal and irrational to try and completely isolate the effects of accounting information on decision because it is only part of the total information influencing decisions."

The list of properties under the particular activity to which they most directly relate identified by the authors of the A.A.A. Committee Report (24) is as follows:-

Problem Specification

Relevance

Measurement

Accuracy	Comparability
Consistency	Uniformity
Neutrality	Flexibility
Objectivity	Adaptability
Precision	Traceability
Aggregation	Reliability
Verifiability	

Transmission

Timelines  
Aggregation

Response

Understandability  
Acceptability  
Motivation  
Fairness  
Mutuality of Objectives

(23) T.A. Lee "Psychological Aspects of Accounting"  
Accounting and Business Research. Summer 1975 Pages 231,232

(24) A.A.A. Committee 1974 op cit

Although the importance of anyone subsystem activity within the internal accounting information system cannot be entirely judged by the number of attributes identified as criteria of that activity, particularly as some of the criteria overlap or group with each other, nevertheless the comprehensive nature of the list of attributes or properties of the measurement activity suggests that this activity is an essential and important section of the information system.

From the more cursory examination of these properties listed under the activity of measurement as being beneficial attributes to decision makers, the indication is that these properties are the areas most likely to have a direct link with work measurement. The properties listed under the activities of problem specification, transmission, and response, on the other hand appear to be linked with the functioning of the accounting system itself or with the organisational environment within which it operates rather than with the generation of the data base for the system, and their examination is deferred to a later stage in the research.

## 2.5 Measurement

Yuji Ijiri (25) describes measurement as an assignment of numbers to objects in such a way, that the purpose of measurement viz the representation of given relations among objects by the predetermined relations among numbers, is achieved.

Other writers on accounting information tend to generalise in stating that measurement is the task of the accountant, and although

(25) Yuji Ijiri, Foundations of Accounting Measurement. A Mathematical Economic and Behavioural Inquiry, Prentice Hall Inc. New Jersey 1967. Page 21

this may be considered a valid view in relation to such objects as cash flow and asset valuation, the statements that the accounting information system is concerned with "collecting" quantitative data, imply other subsystems where numbers relate to objects in the labour element variable of costing information.

As already mentioned, some of the properties listed under measurement either overlap or coalesce into groups and a priori they are now formulated into the group properties of accuracy, comparability and objectivity as a framework for proceeding with the analysis and discussion of management accounting and its links with work measurement.

## 2.6 Accuracy

James C. Emery (26) suggests that accuracy refers to the degree to which sensed information corresponds to the entity it purports to measure, and also the degree to which a predicted value (sales forecast) corresponds to the eventual actual value. He points out a variation in the needs of a decision maker with regard to accuracy in that "lower level" decisions i.e. those concerned with planning and controlling routine operations will require a finer discernment in the correspondence of the sensed information to the entity. It will need, for example, to be fine enough to distinguish between different types of the same product in contrast to the coarser type of sensor whose inaccuracy in relation to a specific entity may be smoothed over because of the aggregation which is a feature of "high level" strategic or policy decisions:

(26) James C. Emery op cit Pages 98-107

" as an information system provides an abstract analogue of the organisation and its environment, a more detailed analogue gives a higher resolution than does an aggregate analogue."

The general useage notion of accuracy can be reasonably considered as encompassing both precision and reliability. The concept of precision and reliability and the link between them - bias - are illustrated by the rifle analogy. The property of precision alone is indicated by close clustering of shots on a target around a mean position but away from the bulls eye. Reliability is illustrated by a scatter of shots, around the bulls eye, one or more of which will probably have hit the bulls eye. Or again, a precision measure with a micrometer could give results to within two ten thousandths of an inch but the instrument might be so biased to the extent that none of the readings was within TWO thousandths of an inch of the true value. A measure with reliability features would be demonstrated by an instrument whose readings varied  $\pm$  half a thousandth but contained the true value within the range of readings.

The appropriate limits of accuracy of accounting information depend to some extent on the sensitivity in the information supplied. A capital investment decision of a capital intensive nature will be less sensitive to labour cost information than a volume-cost-profit decision concerning an assembly activity using cheap components.

Or again, in the inventory control decision as C.T. Horngren (27) points out and demonstrates:

(27) Charles T. Horngren op cit Pages 541, 544

"Total annual expenses of inventory control are fairly insensitive to moderate changes in order size."

The labour costs of storekeepers and material handlers of high value, low volume goods, are even less sensitive in the inventory decision model and so the limits of accuracy of measurement of such costs are less critical. Sensitivity analyses can reveal the critical variables that demand close attention. If the pay-off from a decision model is shown to be highly sensitive to a given variable, effort can be spent in refining the measure of that variable. Such a refinement could arise from adopting Richard Mattessich's (28) suggestion that by appreciating the degrees of accuracy that the probabilistic model of measurement yields as against the deterministic model, accountants could provide more useful information for decision makers.

The general question could be posed as to whether too much emphasis is being placed by accountants on the need for accuracy precision and reliability. Is it necessary or economical to have absolute accuracy down to the last penny? Robert Anthony (29) points out that accounting figures are approximations, some of them only rough approximations as is the case with the measure of the probable price at which a company car can be sold off or traded in.

Business decisions, he maintains, have often to be made with imprecise data. A critic of the accountants concern with accuracy is Leonard Spacek (30) who comments that by an overconcern with

(28) Richard Mattessich. *Accounting and Analytical Methods*. Richard D. Irwin Inc Ill 1964 Pages 80-81 and 247-250

(29) Robert N. Anthony. *Management Accounting Texts and Cases* Richard D. Irwin Inc Ill 1970 Page 819

(3) Leonard Spacek "Can We Define Generally Accepted Accounting Principles" in *Readings in Accounting Theory*. Ed Paul Garner Kenneth B. Berg - Houghton Mifflin Coy Boston 1966 Page 82

accuracy and precision they are losing sight of the substance of accounting objectives. Bubb, Hussey and Smith (31) question whether last-penny accuracy, probably justified in stewardship accounting, is required for managerial decision making. They point out that errors in fact do exist in accounting reports which are presenting figures as though they were absolutely accurate. By giving consideration to confidence limits and confidence levels of the figures they indicate a method of examining the effect of the build up of error arising from projected calculations.

Accuracy of measurement has upper and lower bounds and an upper bound of 100% accuracy can be fairly readily perceived as being neither possible to achieve nor necessarily essential. The lower bound is somewhat more difficult to specify, a difficulty which can to some extent be overcome by considering the sensitivity of various decision models to inaccuracies in information supplied. In spite of the absence of general rules about this lower bound of accuracy the A.A.A. Committee Authors (32) in conclusion comment that it appears to be sufficient to assert that:

" accuracy may be interpreted as a relevant quantifiable criterion for choosing among alternative accounting structures."

Work measurement has certain properties which may be viewed as having importance to the measurement concept of management accounting information systems and the contribution such systems make to decision making. Work measurement is a technique which matches

(31) P.L. Bubb M.K.Hussey & J.E. Smith "Just how accurate are your figures?" in Management Accounting September 1973 p.348

(32) A.A.A. Committee op cit Page 85

Yuji Ijiri's (33) description of measurement in that it is an assignment of numbers to objects in such a way that predetermined relations between numbers, i.e. incremental units of time are used to achieve a faithful representation of given relations among objects - objects being in this case, work tasks which aggregate to the labour element variable of costing information.

The accuracy component of an accounting information system locks in with a high degree of matching to the measurement structure of work measurement. The requirement to take separate measures of the sub-divisions or elements of production operations is a form of detailed analogue which gives a high resolution of image or degree of representation (see Barnes (34), Niebel (35) and Rotroff (36)). Other systems of measurement such as sales value, yards produced, tons produced, may claim reliability in that the true value lies within the range of the measured values, but by a separation of actual working time from non-working time and by the use of rating to refine observed times into basic or normalised times and by consistent procedures for predicting rest periods and contingency interruptions, work measurement can claim high levels of both reliability and precision. Such procedures are described by

- (33) Yuji Ijiri op cit Pages 21, 22
- (34) Ralph M. Barnes. Motion and Time Study: Design and Measurement of Work. John Wiley & Sons Inc. New York 5th Ed. 1963 Pages 359, 360.
- (35) Benjamin W. Niebel Motion and Time Study Richard D. Irwin Inc Ill 5th Ed 1973 Pages 293-299
- (36) Virgil H. Rotroff Work Measurement Reinhold Publishing Corporation New York (1959) Pages 36-39

Barnes (37), Niebel (38) and Rotroff (39). The probabilistic models of measurement as suggested by Richard Matessich (40) and Bubb Hussey and Smith (41), do, in fact, form a part of the work measurement system and values expressed as having limits of accuracy at specific confidence levels, as explained by Barnes (42) and Niebel (43), exemplify this approach.

An assessment of the validity of the claims in respect of different properties of work measurement to add up to a system which is of importance to measurement in the accounting information system is contained in the next chapter.

(37) Ralph M. Barnes op cit Chapters 15 and 16

(38) Benjamin W. Niebel op cit Chapters 25 and 26

(39) Virgin Rotroff op cit Pages 39-49

(40) Richard Mattessich op cit Pages 80-81 and 247-250

(41) P.L. Bubb M.K. Hussey and J.E. Smith op cit

(42) Ralph M. Barnes op cit Page 379

(43) Benjamin W. Niebel op cit Pages 310, 318

## 2.7 Comparability

In correspondence with the views of the A.A.A. Committee (44) consistency and uniformity are viewed here as associates of the criterion of comparability. Comparability is listed by Boris Popoff (45) in his review of postulates principles and rules, as a communication principle. He suggests that information reported in different accounting periods should be based on consistent accounting measures so that representative comparison can be made between one time period and another. Comparability would appear to depend on like events being reported in a like manner, or there being a one to one match between the assignment of numbers or symbols to objects of similar dimension in different periods irrespective of the accuracy of the assignment of the numbers themselves. The postulate that Maurice Moonitz (46) derives in relation to consistency is that:

"The procedures used in accounting for a given entity should be appropriate for the measurement of its position, and its activities should be followed consistently from period to period."

This continued use of the same rules and procedures by the same company over time, is extended by Richard Mattessich (47) who in his derivation of basic assumptions deduces consistency requirements not only for the same entity over different time periods but for different entities over the same time period and other combinations of differences in time periods or entities that may arise. William J. Vatter (48) regrets the lack of consistency in the treatment of

(44) The A.A.A. Committee op cit Page 85

(45) Boris Popoff - "Postulates Principles & Rules" Accounting and Business Research, Summer 1972 Pages 186 and 187

(46) Maurice Moonitz "Accounting Postulates" Readings in Accounting Theory Ed Paul Garner and Kenneth Berg Houghton Mifflin Co. Boston 1966

(47) Richard Mattessich op cit Page 46

(48) W.J. Vatter "Postulates and Principles" Readings in Accounting Theory Ed Paul Garner & Kenneth B. Berg Houghton Mifflin Co. 1966

entities at the hierarchical level of the whole company and regards the difficulty of making comparisons between companies as a real problem in accountancy; a view from which can be deduced that the consistency of treatment of internal entities is a desired objective. The emphasis on consistency does not mean that accounting methods once adopted, must never be changed. The A.A.A. Committee (49), and others, warns that strict uniformity over time i.e. the continued use of the same rules and procedures over time could limit the type of information made available for special decisions, for example in the long range planning area or in a pricing decision. Uniformity it seems, may be breached, provided that the changes in the method adopted by the accountant follow a common consistency of approach and add to the usefulness score of the information by, for example, increasing the comparability.

The question is raised as to what is the basic for the concern over comparability and consistency in the accountancy information system. Is it a component of usefulness to the decision maker or does it lack significance within the decision process? It might be that the concern for consistency is a manifestation of the systems theory concept of growth through internal elaboration, of an attempt to reach higher levels of differentiation and organisation as an end in itself within the system. Because the accounting information system uses measures and these measures are quantitative; because it measures specific entities at finite time intervals within a concept of continuity, the momentum of internal conservation rather than the needs of decision makers may carry the system as of its own accord to adopt the continued use of the same rules and procedures.

a reference to the nature and type of decisions already identified might indicate the needs of the decision maker for comparability based on consistency and uniformity. The non routine decision associated with formulating major plans and policies may be less dependent on comparability of entities over time periods. The problem solving question about choosing the best of several ways of doing a job, or of which particular make and design of machine tool to acquire, although requiring a consistent method of evaluation to be applied to the alternatives, do not necessarily need to use the same model rules and procedures used in an earlier period. However, if the policy decision is concerned with the continuity or termination of one entity as against another within the enterprise and if the prediction of future performance is build on a projection of past performance, then comparability based on consistency and uniformity of rules and procedures of measurement would have a stronger claim for importance. Decisions concerning evaluation of performance, decisions which are dependent on the analysis of variance, however, are by their very nature even more dependent on consistency of rules and procedures of measurement.

The extent to which comparison, matching like with like, can be made between entities such as departments, cost centres, or jobs and operations over time periods, would seem then to be an important indicator of the usefulness of information to decision makers over a wide range of decision models. William J. Vatter's (50)

view of consistency is that it is a doctrine based on the idea that usefulness of information is related to comparability. From the various sources referred to it is fair to reach a conclusion that the most appropriate accounting system will be that which best facilitates comparisons in a specific context, and that the criterion of comparability warrants heavy weighting when assessing the benefits of different information systems.

The methodology of work measurement is seen to be a set of rules and procedures for measurement which have a high degree of uniformity and consistency matching that advocated as a beneficial property of an accounting system. According to writers on the subject, time study is regarded as the basis of most of work measurement and the same sequence of steps in carrying a time study as set out by Michael Avery (51) is also advocated by Barnes (52), Niebel (53), Currie (54) et al.

Given some degree of variation in the scales used for rating which in any case have been narrowed extensively in recent years and some flexibility in the approach to compensating rest allowance, the methodology of the individual steps of work measurement as advocated by these writers is also seen to have a high degree of consistency and uniformity.

- (51) Michael Avery Time Study Incentives and Budgetary Control  
Business Publications London 1964 Page 43
- (52) Ralph M. Barnes op cit Page 353
- (53) Benjamin Niebel op cit Chapters 14, 15, 16
- (54) R.M. Currie. Work Study Pitman 1960 Pages 108 and 109

## 2.8 Objectivity

The A.A.A. Committee authors (55) suggest that verifiability, neutrality, traceability, are associated with objectivity to form a set of properties related to the measurement process. Individual writers also focus on objectivity with verifiability, neutrality and traceability as supporting characteristics of objectivity. Glen Johnson and James Gentry (56) indicate that accountants use various kinds of evidence to support their information output but that:

"The best evidence in the eyes of the accountant is that which is most objective, that is, that which is least influenced by personal opinion and judgement.... In short, accounting data should be verifiable and free from bias."

Paton and Littleton (57) are referred to both by Paul E. Fertig (58) and Harold E. Arnett (59) as linking freedom from distortion by personal bias and verifiability as a basis for objectivity of accounting measures, and are quoted as saying that objective evidence is:

".... evidence which is impersonal and external to the person most concerned in contrast with that person's unsupported opinion or desire."

- (55) The A.A.A. Committee op cit Page 87
- (56) Glen L. Johnson & James A. Gentry - Finney & Millers  
Principles of Accounting Prentice-Hall Inc. New Jersey 1970
- (57) W.A. Paton and A.C. Littleton An Introduction to Corporation  
Accounting Standards Monograph NO.3 Ann Arbor, Michigan,  
American Accounting Association 1940 Pages 18 & 19
- (58) Paul E. Fertig "Current Values & Index Numbers: The Problem  
of Objectivity" in Research in Accounting Measurement  
Ed Robert J. Jaedicke et al American Accounting Assoc-  
iation 1966 Page 138
- (59) Harold E. Arnett "What Does Objectivity Mean to Accountants?"  
in Garner and Berg op cit Page 180

T.A. Lee (60) presents a view that accounting is not merely a mechanical process but is a social service which through its systems and information provision has an impact and influence on human behaviour. He suggests users of accounting information will only allow it to influence their behaviour if they have confidence in its reliability and in the processor's objectivity:

"The credibility of the information rests largely on the credibility of the information process and processor."

Presumably when he speaks of behaviour being influenced in a positive manner towards achievement of organisational goals he is not necessarily implying only a nil response if the information is perceived to be biased. Behaviour, indeed, seems to be influenced not infrequently in a negative manner and dysfunctional to achievement or organisational goals, if the information or the processor is perceived by the user to be biased against him or his section.

Adrian Buckley and Eugene McKenna (61) in their review of those theories of behavioural scientists most related to budgetary control, abstract from those theories a stated need for legitimacy of standards and further more that the derivation of those standards must be understood by those affected. Although writing about external information systems Boris Popoff (62) derived a requirement necessary to achieve fairness to affected parties the principle of which may be considered applicable to internal information systems.

(60) T.A. Lee op cit Page 225

(61) Adrian Buckley and Eugene McKenna "Budgetary Control and Business Behaviour" in Accounting and Business Research Spring 1972 Pages 137-150

(62) Boris Popoff op cit Page 184

He suggests that analysis and interpretation should be neutral in the face of conflicting interests and that only accounting reports which reflect "truth" of economic entities can be said to achieve fairness to affected parties.

Harold E. Arnett (63) whilst accepting these various definitions as a satisfactory basis for further analysis maintains they are not operational in content and he searches for extended definitions having a more operational content. He finds statements which add up to an assertion that:

"....a financial transaction can be said to be objectively determined when there is both a definitely established event (bargain or exchange) and an accurately measureable amount (quantitative expression of the transaction in money)".

A further requirement is that the transaction should be the result of "arms length" bargaining between genuinely independent parties and that the origins of recorded transactions can be examined and substantiated by an independent investigator. Arms length transactions were originally those between independent and unrelated buyer and seller but the arms length transaction has now become a concept of standard of fairness of values determined by other means such as a concensus view or the going market rate.

Harold E. Arnett (64) exemplifies an operational broadening the objectivity criteria by referring to depreciation accounting which aims to be objective and yet is not the result of an "arms length" transaction, neither can the amount often be calculated.

(63) Harold E. Arnett op cit Page 181

(64) Ibid Page 185

The data is apparently objective as long as it is not dictated by managerial whim, is not derived carelessly, but is determined intelligently by say, engineering estimates of physical life, adjusted by factors such as obsolescence. This, together with other examples which are not consistent with the more rigid definitions leads Arnett (65) to conclude that the usefulness concept appears to be the cohesive force holding all approaches together.

"Apparently then any data which are considered useful are objective to accountants provided they are substantiated or capable of being substantiated by an independent party."

Paul E. Fertig (66) finds some statements which also imply that there is a trade off between degrees of objectivity and increase in usefulness; that "usefulness is somehow substitutable for objectivity." He maintains however that it is surely more acceptable to think of objectivity as contributing to usefulness, and he quotes Patons and Littleton's (67) view that there are varying degrees of objective determination and that the most objective facts can be given preference and efforts can be made to upgrade the lesser objective data.

The A.A.A. Committee Authors (68) conclude that increased verifiability or objectivity is a desirable property to be looked for in a measurement system perhaps carrying a greater weighting

(65) Ibid Page 188

(66) Paul E. Fertig op cit Page 140

(67) Paton and Littleton op cit Page 19

(68) A.A.A. Committee op cit Page 88

in an external system than in an internal system. On balance the conclusion can be drawn that objectivity is of sufficient importance for it to be considered by users as one of the measures of usefulness of the system.

The Authors of the A.A.A. Committee (69) also quote Ijiri and Jaedick's (70) note that objectivity is affected by the measurement procedure and its specification of rules, the skill of the measurer and his personal bias. The Committee suggests that:

"if the measurement rules are specified in great detail little will be left to the judgement of the measurer in applying the measurement rules."

and that this greater detail, together with less subjective judgement will lead to easier verification.

Thus the detailed specification of measurement rules which is a feature of work measurement not only contributes to comparability but in the sense that it leaves less to the judgement of the measurer it also contributes to objectivity. A further contribution of the procedure is that the detail leads to easier traceability and verifiability. It is not the record per se which is significant but the detail; for example records may be available to the accountant of labour cost per object in the form of piece work contracts, but because of their simplistic nature it is less easy to trace and verify such measures.

(69) Ibid Page 88

(70) Yuji Ijiri and Robert Jaedickes "Reliability and Objectivity of Accounting Measures" The Accounting Review Vol. 41 No.3 (July 1966) Pages 476-477

Virgil H. Rotroff (71) and the I.L.O. Publication on Work Study (72) give some indication of the personal qualities required of work measurement practitioners and include sincerity - honesty - emotional stability and integrity in their list of qualities which contribute to the freedom from bias in the measurer.

Given the normative form of training within its semi-professional context and by practising the acquired skills and methodology, the measurer may consequently be expected to be independent of the whims of management or of the parties performing tasks, and consequently to generate confidence in his objectivity. The position and role of the work measurement practitioner within the organisation also contributes to objectivity in that normally the position is a neutral one in which he is freed from any felt need to exercise power, to win or score over other parties and in which he has the opportunity to see different points of view.

This review of the measurement activity of the management accounting information system and of its properties has traced the most direct links across the interface with the work measurement system. These properties are grouped into classifications of accuracy, comparability and objectivity and as such may be observed as variables existing to some degree or other within information systems for decision makers.

The other activities of a management accounting information system viz problem specification, transmission and response together with

(71) Virgil H. Rotroff "Work Measurement" Reinhold Publishing Co. New York 1959 Page 185

(72) International Labour Office "Introduction to Work Study" I.L.O. Geneva 1964 Page 54

their respective properties are viewed here as having less direct links with the work measurement system. They are not regarded as being without influence on decision makers but their origin of influence lies outside the work measurement system and is partly within the accounting system itself and partly within the organisational system surrounding the decision maker. Consequently, they are regarded as external variables to be either held constant or monitored and their nature and role in the research design are examined in Chapter Five.

## 2.9 Management Accounting and the Small Business

This analysis of management accounting information systems and the identification of the links between them and work measurement has been based on general literature and research covering a wide range of company size. It is appropriate to examine whether the techniques of management accounting are thought to be applicable in small business units and are in practice used by them. The Bolton Report (73) includes costing and control information as techniques which have a potentially beneficial use in small business in spite of the constraint that size might have on managerial skills. The way in which small business can gain from the use of accounting and cost control systems is described and discussed by such authors as Reddington (74) who maintains that control is essential to the prosperity of the small business and that accountants should provide the communication channel between

(73) Bolton J.E. Report of the Committee of Inquiry on Small Firms London H.M.S.O. 1971

(74) Donald A. Reddington "Control Methods for Small Business" Management Accounting (US) 1973 Vol.55 Pages 15-17

the decision making process and the report of the operational results.

Wood (75) suggests how accountants can help small firms develop budgetary control as a tool of management for guiding a small business on the right lines and stresses the need for systems of cost control of labour, ideally with standards based on work study data. Victor Parker (76) writes that one of the most important matters for the furniture manufacturer, is to ensure that he understands the effect of all his activities on cost so that at the end of his accounting period he can see his financial position and why it has occurred. In emphasising the importance of costing whatever the size of business he suggests that this review needs to be done even if the firm is too small to employ a full time accountant.

Gary Luoma (77) in his research into the use of accounting information by small and medium manufacturers found that in practice accounting data are used beneficially by management only on a minor scale in certain decision areas and that the sophisticated manipulation of accounting data by linear programming and other mathematically orientated techniques is not generally encountered. However, he recommends that as research has shown

- (75) E.G. Wood "Room for a Good Little 'un'" Accountancy 1973 Pages 17-21
- (76) Victor Parker Costing in the Furniture Industry. Pergamon Press 1965 Chapter I Pages 1-10
- (77) Gary A. Luoma Accounting Information in Managerial Decision Making for Small and Medium Manufacturers. Research Monograph 2 National Association of Accountants

that the application of theory and techniques of managerial accounting can be highly useful in the managerial decision making process, many small and medium sized firms should begin to use more of the concepts, theory and techniques, at the unsophisticated level, in order to achieve greater benefit from their decision making. He suggests that this stage be accomplished before attempting to use the more sophisticated techniques. Other research, carried out by Jones and Awad (78), into the use of "modern" or "new" techniques of management accounting by small manufacturing firms also found that sophisticated techniques such as linear programming were not as widely used as might be expected. However, more use was made of basic techniques in that almost two thirds of companies in the sample used operating budget techniques and half the companies used standard costing and cost-volume-profit analysis.

Swann (79) in a U.K. study in 1970/71 found a comparatively high utilization (between 25% and 40%) of such techniques as cost control, production planning and work study by small businesses. There was a statistically significant lower utilization of other more sophisticated techniques, such as operational research, which indicated in his view an emphasis on techniques which provide basic data essential for day to day management of production. The observations and conclusions of the foregoing researchers and authors indicate in the main that the techniques of management

(78) Gardner M. Jones and Saber A. Awad "The Use of Accounting Techniques in Small Firms". Management Accounting (U.S.) February 1972 Pages 41-43

(79) K. Swann "Management Attitudes and Techniques in the Small Company" unpublished Thesis, University of Bradford 1971

accounting is applicable in small business units and is used in practice by a sufficient number of them to provide a basis for research investigation. As such they confirm the casual empirical identification of applicability and use, made by the author of this report in the course of his early involvement in management development in small business units in the North East of England.

#### 2.10 Summary

This chapter in examining management accounting and its links with work measurement, first of all defined management accounting and its objectives in terms of the assistance it aimed to provide to meet the different requirements of decision makers such as performance evaluation and problem solving. Two particular sections of management accounting, budgetary control and standard costing, were then considered and an initial relationship with work measurement was established. The separate activities of a management accounting information system were then set out together with the criteria or properties thought to be beneficial to decision makers. The activity of measurement and its constituent properties of accuracy, comparability and objectivity were then analysed in depth and links between these and certain elements of work measurement were brought into sharp focus. The examination of other activities such as transmission and response, thought to be less directly linked with work measurement was deferred until later. Finally the application of the technique of management accounting and its properties, to the field of small business was examined and seen to be relevant to this area.

CHAPTER IIIWORK MEASUREMENT AND ITS CONTRIBUTION TO MANAGEMENT ACCOUNTING3.0 Work Measurement and Management Accounting

Chapter II examined the characteristics of management accounting systems in order to distinguish the criteria of internal management accounting systems thought to be beneficial to decision making. This identification of properties revealed that some of these properties namely accuracy, comparability and objectivity, have a direct link with certain elements of work measurement which complement and contribute to them. These links having been proposed, Chapters III and IV now examine their origin as elements in work measurement so as to enquire into their nature and the validity of their contribution to the managerial accounting properties. In order to assess the contributory nature of these elements and to search for other relevant contributions the earlier development and current state of work measurement are analysed in some detail. The framework for such an analysis is shown in the following matrix, where the individual units which comprise the work measurement system are listed and where suggested contributory links with relevant management accounting properties are marked:-

TABLE I

Potential Links Between Properties Of  
Works Measurement And Management Accounting

Management Accounting Work Measurement	Accuracy	Comparability	Objectivity
Element Division and Recording	X	X	
Timing Methods	X		
Rating	X	X	X
Allowances		X	X
Predetermined Motion Time Systems		X	X
Training & Recruitment of Practitioners		X	X
Experience of Practitioners			X

Two areas of knowledge are examined on the basis of this matrix of contributory links. The first area, which is examined in this chapter, is what authoritative writers in the field consider to be the substantive body of theoretical knowledge of work measurement, modified and refined by the analysis of a number of researchers. The second area of knowledge, which is examined in Chapter IV is that of the state of work measurement in practice - the empirical perception of the technique of work measurement and its parameters and sub systems.

### 3.1 Historical

In considering the validity of the claims in respect of different properties of work measurement to add up to a system which is of importance to the measurement activity, and its characteristics of accuracy comparability and objectivity, of the management accounting information system reference is now made to the origin and subsequent development of work measurement. There is general agreement between such writers as Barnes (1), Karger and Bayha (2) Niebel (3), and Whitmore (4) that the modern and first definitive approach to work measurement was by F.W. Taylor at the Midvale Steel Works in the 1890's. At the same time they acknowledge the earlier example of time studies by M. Coulomb and Jean Perronet in the 18th Century and Charles Babbage in the 19th Century.

An early feature of Taylor's approach was the breaking up of the work assignment into small divisions of effort known as elements. Over several years this approach had been extended and refined and, as reported by Karger & Bayha (5) and Barnes (6), was promulgated by Taylor to the American Society of Mechanical Engineers in 1912. He divided time study into the two broad divisions of analytical activity and constructive activity.

- (1) Ralph M. Barnes. Motion and Time Study: Design and Measurement of Work John Wiley New York 1963 Pages 10-15
- (2) Delmar W. Karger and Franklin H. Bayha. Engineered Work Measurement Industrial Press New York 1966 Pages 3-8
- (3) Benjamin W. Niebel. Motion and Time Study, Richard D. Irwin Homewood Inc. 1972 Pages 9-17
- (4) Dennis A. Whitmore. Work study and related management Services Heinman London 1968 Pages 3-6
- (5) Karger and Bayha op cit Pages 4/5
- (6) Barnes op cit Page 10

Analytical activity comprised dividing the task into simple and essential elementary movements and recording the timings of the best method of making each movement. The analysis was carried further by a study of unavoidable delays to production, of the effect of the newness of a job to a worker, and of the timing and extent of rest periods. Taylor's constructive division of time study consisted of classifying and recording frequently used elementary movements into suitable groups from which the set of motions required for almost any task could be selected and the time required compiled. Also the analysis usually gave opportunity for constructive modification of inadequate tools or conditions.

That important and difficult part of work measurement concerned with evaluating the performance of the person during the time when work is being measured is known as rating and one of the first references to formalised rating appears to be to the work of Charles E. Bedaux. According to Barnes (7) the time study procedure used by Charles E. Bedaux around 1916 included both the rating of the operator's skill and effort and the use of a standard table of fatigue allowances. The Bedaux method was to use a point system where an operator working at normal pace would be rated at 60 points to the hour whilst an operator responding to incentive payment would have a performance of 70 to 80 per hour. Barnes (8) suggests this was a definite improvement over the earlier and informal method of rating operator performance which was to arbitrarily select appropriate watch readings

(7) Ibid Page 382

(8) Ibid Page 382

according to whether the operator was judged to be working at a fast tempo or a slow tempo. Barnes (9) refers to a further development of rating, the Westinghouse or LMS system (Lowry Maynard & Stegmerten), which was a four factor system for rating operator performance levels which was used in the mid twenties. The four factors to which a numerical value was awarded were skill, effort conditions and consistency.

Another significant development of work measurement of the inter-war years was the application of statistical theory to time study on textile machines which was the beginnings of activity sampling. This was a technique suitable for providing information about proportions of delays working time and machine utilization, faster, and at less cost than by watch methods.

Niebel (10) points out that since the days of Taylor, management has realised the desirability of assigning standard times to various basic motions that occur in activity and he acknowledges the work carried out independently in the inter-war years by W.G. Holmes, Harold Ergstrom at GEC, and A.B. Segur, to develop synthetic basic motion times. The authors of the ILO (11) text refer to the development of a number of systems of predetermined motion time standards such as Methods Time Measurement, Work Factor and Basic Motion Times. These various

(9) Ibid Page 382

(10) Niebel op cit Page 417

(11) International Labour Office. Introduction to Work Study  
I.L.O. Geneva 1964 Page 298

systems were generally compiled from the frame by frame analysis of a large number of film studies of each movement of a wide variety of tasks.

Stop watch procedures and time recording machines have also been used to establish synthetic standards - see Niebel (12).

Karger & Bayha (13) point out that the M.T.M. approach joins together the time study approach of Taylor with the motion analysis philosophy of the Gilbreths to which is then added the concept of performance rating. In all they suggest this produces an effective procedure to analyze any normal operation into the basic motions required to perform it and assigns a time standard to that motion. Thus synthetic basic motion times can be compiled for activity accurately and more quickly than waiting for actual production runs to be timed by stop watch or other means.

### 3.2 Contemporary Work Measurement and Management Accounting

Consideration is now given to those aspects of the contemporary scene of the management science of work measurement which have a particular link to the characteristics of management accounting information systems.

### 3.3 Element Division and Recording

Writers such as Barnes (14), Niebel (15), Currie (16) and

(12) Niebel op cit Page 420

(13) Karger & Bayha op cit Page 48

(14) Barnes op cit Pages 358-361

(15) Niebel op cit Pages 295-299

(16) R.M. Currie. The Measurement of Work. British Institute of Management 1956 Pages 32-34

Whitmore (17) agree that in carrying out the work measurement of any operation the procedure requires the division of the operation into elements and a record making of the method used. They point out that the division of the operation into elements provides certain facilities in the whole measurement procedure. It increases the value of the study by providing the facility for discreet portions of the operation to be studied rather than merely providing a record of the total time required per cycle to do work. This for instance, provides the opportunity to check that all the elements being performed are necessary and to be included in the measurement assigned. It enables machine time to be separated from manual time. Hand time is more variable and harder to determine precisely and is separated in order to contend with this difficulty. The opportunity is created to divide constant elements, those which are independent of the piece being worked on, from those variable elements where the time will vary according to the characteristics such as size or weight of the particular piece. Again as Karger & Bayha (18) indicate, the procedure of a Pre-determined Motion Time System such as M.T.M. requires the analysis of a manual operation into the basic motions required to perform it and the conditions under which it is performed recorded so that the appropriate predetermined time standard is assigned to that motion.

The division of an operation into elements and the requirement to take measures of these elements by incremental units of time links with management accounting information systems in that it has a

(17) Whitmore op cit Pages 61-62

(18) Karger & Bayha op cit Pages 50-51

close match with Yuji Ijiri's (19) concept of measurement. This is an assignment of numbers to objects so that the predetermined relations between numbers are used to achieve a faithful representation of given relations among objects. In this case the objects are work tasks which aggregate to the labour content of costing information. The opportunity that arises to check that all elements being performed are in fact, necessary to be included in the measurement increases the extent to which there is a faithful representation of the relations between given objects - work tasks - and the time allocated to them.

This division into elements is also compatible with Emery's (20) concept of increasing accuracy of control information systems arising from a more detailed analogue giving a higher degree of focus than an aggregate analogue. It meets his suggestion that decision makers may require measures which are fine enough to distinguish between different types of the same product.

This contribution of work measurement to management accounting information systems is qualified however by the view, see Whitmore (21) that errors arising from the attempt to measure individual elements of a short duration may aggregate to a lesser than accurate total than if overall measures of a work cycle had been taken. He consequently suggests that such errors be

- (19) Yuji Ijiri. Foundations of Accounting Measurement. A Mathematical Economic & Behavioural Inquiry. Prentice Hall Inc. New Jersey 1967
- (20) James C. Emery. Organizational Planning & Control Systems Theory and Technology. Macmillan London 1969 Pages 98-107
- (21) Whitmore op cit Page 61

minimised by recommending 0.1 of a minute as does Currie (22) as the smallest fractional length element to measure in contrast to elements of 0.04 minutes as suggested by Niebel (23) and also by Mundel (24). The possibility of error is also minimised if the elapsed time check, as recommended by Whitmore (25), Currie (26) and Niebel (27) is carried out. When elements and cycles are being timed continuously such a check compares the summation of individual readings with a separate clock or watch reading of the elapsed time from start to finish of the study.

Barnes (28) and Niebel (29) stress the importance of having a careful record of the method used, the presence and location of tools and fixtures, the materials used and conditions surrounding the job in order to ensure the value of the study as a source of data for synthesising standards on similar jobs in the future. Niebel (30) emphasises the recording of conditions as having a definite relationship to allowances of time for personal needs and fatigue and the need for comparison with possible changed conditions either of a permanent nature or of a temporary nature

- (22) R.M. Currie. Work Study. British Institute of Management 1972  
Page 137
- (23) Niebel op cit Page 298
- (24) Marvin E. Mundel. Motion and Time Study Prentice Hall  
New Jersey 1950 Page 320
- (25) Whitmore op cit Pages 89-90
- (26) Currie op cit Pages 38-39
- (27) Niebel op cit Page 319
- (28) Barnes op cit Page 358
- (29) Niebel op cit Page 295
- (30) Ibid Page 296

as with climatic conditions. Mundel (31) as well as referring to increasing the value of a time study for future determination of time values for synthesised standards, points out:

"The actual practice is not static and as time passes, almost invariably changes. Without an adequate description of what was timed there is no means of evaluating a change."

The link between the work measurement requirement of careful recording and the management accounting system lies in that such comparison, matching like with like, is an indicator of the usefulness of information to decision makers.

Matching like with like in work task entities across departments or between the same operation over time periods is helped by this feature of careful recording. Furthermore, this type of matching is the nature of comparability that Vatter (32), Popoff (33) and the authors of the AAA Committee Report (34) consider to be a characteristic of useful information.

#### 3.4 Timing Methods

The timing devices required to establish observed time values of an actual operation are generally of three types, stop watches, motion picture cameras, and time recording machines. Barnes (35)

(31) Mundel op cit Page 317

(32) William J. Vatter "Postulates and Principles" in Readings in Accounting Theory Ed Paul Garner & Kenneth B. Berg Houghton Mifflin Co. Boston 1966 Page 31

(33) Boris Popoff - "Postulates Principles & Rules" in Accounting and Business Research Summer 1972 Pages 186-187

(34) Report of the Committee on Concepts and Standards of Internal Planning and Control. American Accounting Assoc. The Accounting Review October 1974

(35) Barnes op cit Page 350

suggests that the stop watch is the most widely used timing device for time study and both he, Niebel (36), and Karger & Bayha (37) indicate that the decimal minute watch, where the large hand makes one revolution per minute and each of the 100 divisions on the dial therefore shows 0.01 minutes, is used more than any other for time study work and is adapted to both the continuous and snapback methods of recording. The watch is kept running from beginning to the end of the operation in the continuous method and the time is recorded at the end of each element. Individual element times are obtained by successive subtractions after the study is complete. In the snapback method of recording the watch is simultaneously read and snapped back to zero at the completion of each element and the element times are entered directly on the time study sheet without the need for subtraction. An additional watch is often used to carry out the total elapsed time check.

Multiple stop watch holders have been designed to enable the analyst to attain even greater accuracy. Mundel (38) describes how by means of a mechanical linkage between the watches one watch can be stopped at the end of an element and another started. Whilst that reading is being recorded the other watch continues measuring the next element and so on. Element times are obtained later by subtracting alternate readings. Niebel (39) reports that

(36) Niebel op cit Page 280

(37) Karger & Bayha Page 457

(38) Mundel op cit Page 331

(39) Niebel op cit Page 281

most stop watches are produced with accuracies of plus or minus 0.025 minutes over 60 minutes of operation whereas U.S. Government specifications of stop watch equipment allow a deviation of 0.005 minutes per 30 second interval. In order to assume continued accuracy of reading he says that proper maintenance and regular checking are essential.

One alternative to the stop watch is a synchronous motor driven motion camera operating at a speed of 1000 frames per minute to time the elements of an operation. Barnes (40) explains that the time taken for each element of the operation can be measured in thousandths of a minute and that by projecting the film at the exact speed at which the film was taken the operator's performance can be related to standard performance. A time lapse drive may also be used to take pictures at 100 frames per minute. Mundel (41) refers to these two methods of camera technique as "full" use of camera at 1000 frames per minute and "partial" use of camera at 100 frames per minute. He claims advantages for these methods in that they are not "interpreted data" as with a stop watch method and they provide an objective record which can be reviewed later by anyone. Niebel (42) suggests there is increasing use by industry of cameras for assigning time values with the development of synthetic time standards and as an improved means of accomplishing a fair and accurate job of rating performance.

(40) Barnes op cit Page 352

(41) Mundell op cit Page 346

(42) Niebel op cit Page 283

Time Recording Machines according to Karger and Bayha (43) have been developed by a number of different companies to utilize, in shop floor studies, the technology originating in research laboratory type work measurement devices. They generally record to hundredths of a minute on paper tape which is punched in response to a keyboard held in the observers hand elapsed time being determined by sealing the tape after the study is completed. Karger and Bayha (44) also refers to a machine with a 0.001 minute element capability and a Pace Simulator to assist in operator comparison. Mundel (45) refers to time study machines as "a sort of compromise between a stop watch and a camera" and that their chief advantage is that the observer using his fingers only to operate the keyboard as a means of recording the time of the element has more freedom to observe the pace of the job. He emphasises the greater opportunity for accuracy, particularly with small elements, of time study machines and cameras but suggests that in competent hands:

"even seemingly complicated stop-watch methods produce results of satisfactory accuracy on elements of typical size."

In considering how many cycles of the operation should be timed by these various devices to attain a satisfactory level of accuracy Mundel (46) explains that there is bound to be some variation in reading to reading for any element even at the same nominal performance pace of the operator:

(43) Karger and Bayha op cit Pages 462-463

(44) Ibid Pages 462-463

(45) Mundel op cit Page 346

"This variation will be caused by the following random variations among other causes:-

- (1) In operator movements
- (2) In the position of parts worked with
- (3) In the position of the tools used
- (4) In the slight errors in watch reading."

He indicates that for any observed pace increasing the number of observations of times from 5 through to 15 cycles will produce a more stable average and that what constitutes a reliable sample of readings may be mathematically determined. He suggests in order to limit the number of readings:

"It would be reasonable to require enough to make the chances 95 out of 100 that we are within 5% of the true average for the element at the pace at which it was performed."

Niebel (47) comments that the number of cycles to be studied to arrive at an equitable standard cannot be completely governed by statistical practice as the number of times the operation is performed per year as well as its cycle time influences the number of cycles that can be studied from an economic standpoint. He supports this view by quoting tables used by two different companies which are used as guide lines for their time study men in the number of cycles to be observed. Niebel (48) however, in common with Barnes (49) and Mundel (50) does demonstrate how (a) the probable accuracy of a sample of timings, and (b) the number of cycles to be

(47) Niebel op cit Page 310

(48) Ibid Pages 310-318

(49) Barnes op cit Pages 364-378

(50) Mundel op cit Pages 335-336

studied to assume a reliable sample, may be determined by application of statistical theory of the normal frequency distribution so that practitioners can calculate the number of cycles required for given levels of confidence and error.

Timing methods contribute strongly to the requirements of both the precision and reliability aspects of the accuracy component of management accounting information systems. Precision is enhanced by the consistency in performance of high quality timing devices provided they are properly maintained. The reliability aspect of accuracy is reinforced, on the one hand by applying statistical theory to determine a sample size to give a faithful representation of the objects and on the other by the opportunity for calibration of the timing devices against a standard so that they are not merely consistent and precise but also are giving true or standard readings.

Allan (51) whilst commenting that timing is the most accurate part of work measurement mentions the work of Winston Rodgers at Acton College and quotes Mundel to support his view that timing is still open to criticism because of the variations in readings of experienced practitioners timing test elements and the greater use of the less accurate "snapback" method as against the "continuous readings" method. Mundel (52) however, was reporting the study of Irwin Lazarus (53) when he stated that the difference in

(51) W.G. Allan "Work Study and Worker Remuneration" unpublished M.Sc Thesis, University of Strathclyde Department of Industrial Administration 1970 Page 71

(52) Mundel op cit Pages 332-333

(53) Irwin P. Lazarus "Nature of Stop Watch Timing Errors" Advanced Management Vol.15 No. 5 May 1950

the average error between the two methods was of statistical significance but then went on to point out that even the larger of the two average errors is not large enough to be of practical significance and that in distinguishing between the two concepts of significance:

"We may conclude that in competent hands either of these two methods is satisfactory, in as much as the error is not large enough to influence any of the subsequent calculations."

### 3.5 Rating

The mean observed time for an element which has been derived by timing a sufficient number of cycles does not necessarily represent the time for an average or normal man to do the job when working at an average pace. To arrive at such a time, the time taken by an above average performer must be increased to that required by a normal worker and the time taken by the lower than average performer reduced to the value representative of normal performance. Various definitions of the average operator are given which include such broad terminology as "qualified employee" and "effective utilization of time" which in themselves require further definition.

The concept is demonstrated in a less qualitative way by Niebel (54) and Barnes (55), both of whom illustrate that in a random selection of a large number of employees the frequency distribution of performance would approximate the normal distribution curve. They quote the results of Ralph Presgraves (56) analysis that the ratio of the variation between the best and worst

(54) Niebel op cit Pages 327-328

(55) Barnes op cit Pages 389-395

(56) Ralph Presgrave Dynamics of Time Study 2nd Ed McGraw Hill Book Co. New York 1945 Chap. 10

performance in such a situation is seldom greater than 2 to 1 in practice, and that there is reasonable dependability in a 2;5;1 range. Niebel (57) shows that in such a distribution with 100 taken as the average performance rating then 68 per cent of the people would be within plus or minus one sigma limit or between performance rating values of 87 and 113 or that 96% of people would be between performance rating values of 74 and 126. The performance rating task of the time study observer then is to observe the performance of the operator during the study and judge its equivalent point on such a distribution.

This performance rating is regarded as a vital step in the work measurement procedure, at the same time as will be seen later, it is the aspect open to most criticism. Systems of performance rating depend essentially on the judgement of the practitioner which is built up upon experience and training. Niebel (58) stresses the need for accuracy and consistency in rating and suggests within a given organisation, different time study analysts using the same method of rating should arrive at standards that do not deviate by  $\pm 5\%$  from the average of the standards established by the whole team of analysts. He suggests that good practice would be to take three or more independent studies as a means of increasing the accuracy of the time standard and demonstrates experimentally how three independent studies reduce the errors in the performance rating process as well as increasing the accuracy of the mean observed time.

(57) Niebel op cit Pages 327-328

(58) Ibid Page 331

### 3.6 Methods of Rating

The Westinghouse or L.M.S. (Lowry, Maynard and Stegmerton) system of rating is referred to by Niebel (59) Barnes (60) and Karger and Bayha (61). This system takes into account four factors:-

- (a) skill
- (b) effort
- (c) conditions
- (d) consistency for rating operator performance.

A scale of numerical values representing verbalised gradings of levels of skill, effort, conditions and consistency is available and the sum of the values of ratings of these four factors assigned by the observer is applied to the observed time. If the sum of the ratings was +0.13 and the observed time was 50cms (0.50 minutes) then the normal time for the operation would be  $50 \times 1.13$  or 56.5 cms.

Barnes (62), Niebel (63) and Mundel (64) all include the following three methods in their writings on rating.

#### 3.6.1 Speed or Performance Rating

This method consists of rating a single factor, variously described as operator speed, pace, or tempo. According to Mundel (65) and Niebel (66) and Currie (67) this is a two step

(59) Ibid Page 334-340

(60) Barnes op cit Page 382

(61) Karger and Bayha op cit Page 95

(62) Barnes op cit Page 386

(63) Niebel op cit Pages 342-343

(64) Mundell op cit Page 350

(65) Ibid Page 350

(66) Niebel op cit Page 342)

(67) R.M. Currie. The Measurement of Work. British Institute of Management, 1956 Page 44

process. Firstly taking into account the difficulty of the job the observer must form a mental concept of effective movements and their speed which equate to the definition of standard performance the observer is working with; the second step is to assess the actual performance of the operator as compared with the concept formed in the first stage and then place a numerical value on this assessment. The British Standards Institution (68) definition of standard performance is:

"The rate of output which qualified workers will naturally achieve without over exertion as an average over the working day or shift provided they adhere to the specified method and provided they are motivated to apply themselves to their work".

Standard rating is then the rating corresponding to this average rate which workers will naturally achieve, and on the British Standard 0/100 Scale, is denoted by 100. Between this 100 level or standard rating and zero representing no work, there are 100 equal divisions and the scale may be extended in equal divisions above the 100 level.

Whitmore (69) describes other rating scales in use such as the original 60/80 Bedeaux scale and the American 100/133 scale, and British Standard 3138 (70) illustrates comparatively the different values on these scales equivalent to standard rating. Barnes (71) and Whitmore (72) point out the inadequacy of verbal definitions of standard performance and that the concept is best acquired by

(68) British Standard Institution BS3138 No. 34001 1969 Page 21

(69) Whitmore op cit Page 67

(70) British Standard 3138 op cit

(71) Barnes op cit Page 391

(72) Whitmore op cit Page 69

demonstration. Currie (73) states that a person walking at a speed of 4 miles per hour is a demonstration of standard performance.

Karger and Bayha (74) point out the difficulty of attaining complete agreement among work analysts of the concept of a performance level. They suggest that probably the best approach and the one having the widest acceptance and usage is that developed by the Society for the Advancement of Management. The S.A.M. has produced a set of rating films which illustrate generally accepted performance levels and which provide a means for sharpening judgement of variations from standard performance. Barnes (75) suggests that after the basic reasoning behind rating is fully understood each company should establish agreement as to what standard performance should be in the factory. Some large companies such as G.E.C. and I.C.I. have made their own set of films to this end whilst others use walking, card dealing or pinboard filling demonstrations.

### 3.6.2 Synthetic Rating

Synthetic rating is a method of rating that was developed by R.L. Morrow (76) that would not depend so much on the judgement of the observer and which would give more consistent results. It

(73) Currie op cit Page 44

(74) Karger and Bayha op cit Page 49

(75) Barnes op cit Page 395

(76) R.L. Morrow Time and Motion Economy. Ronald Press  
New York 1946 Page 241

uses pre-determined motion time values. A time study is made in the usual manner with the actual elemental observed times being recorded. Then as many of these elemental times as is possible are compared with pre-determined motion time values of identical motions. A ratio can be established between the P.M.T.S. value for each of the elements and the actual recorded time value and an average ratio or factor between recorded and P.M.T.S. values can be worked out. Having established an average factor for those elements for which a comparison was possible, this factor is applied to all elements in order to adjust each of them to normal performance.

### 3.6.3 Objective Rating

The rating procedure known as objective rating was developed by M.E. Mundel (77) to eliminate the difficulty of establishing a concept of standard performance for every different type of work encountered by the time study observer. In this method a rating of the observed pace of the job element being measured is made by means of comparison with some bench mark concept of standard performance held by the observer. The rating of the observed pace is made irrespective of the difficulty of the motion pattern of the element being measured. At a later stage a secondary factor is applied to the observed rating in order to take care of the relative difficulty of the task element. This secondary factor takes the form of a percentage increment taken from tables Mundel (78) has derived experimentally which take into account

(77) Mundel op cit Page 353

(78) Ibid Pages 558-595

such influences on the pace of working as weight handled and the amount and nature of body movement. Mundel (79) re-emphasises the fact that judgement, a subjective process, is at the heart of relating observed performance to standard and that to be of significance, this judgement should be based on some demonstrateable bench mark such as a film of a simple job being carried out at standard performance rather than recourse to the personal experience of different time study observers.

Niebel (80) suggests that this procedure will give more consistent real results in that it is easier for an observer to compare the pace of the job being studied to the pace of one that he has thoroughly familiarised himself with, rather than judging simultaneously all the attributes of an operation that form the concept of standard performance for that operation. The secondary factor will also contribute to consistency since there is one set of tables to which observers refer rather than use their individual judgements at the time the elements are being measured, in order to assess the various difficulties present in the operation.

### 3.7 The Contribution and Criticism of Rating

Awareness that the average time of several occasions that a given operator takes to perform a task or activity does not necessarily represent the time an average person would take, has long been present with those concerned with assessing work tasks. In metal working, for example, estimates for production planning purposes, or

(79) Ibid Pages 353-355

(80) Niebel op cit Page 344

in agriculture the basis for agreeing a labour price contract for stocking a field of corn or harvesting a field of mangles by hand, were not being based solely on average times of a high performance worker, nor solely on those of a low performance worker, but on the concept of a normal worker.

Beyond this the additional contribution of the rating aspect of work measurement therefore, to the accuracy of information for management accounting systems would seem to lie particularly in the numerical assessment of the degree of difference from this norm existing in any observed performance. The use of this assessment to derive a representative time has a claim to match Yuji Ijiris (81) concept of faithful representation of actual relations among objects by the predetermined relations between numbers. The rating scales are a set of numbers, comparable to the Ijiris (82) concept, which have a predetermined relationship based on increments of effort whose step size is theoretically equal being standardised from depth experience. The application of the scale relates the actual pace to one of the increments in the scale.

However the parameters, methodology and results of rating have been challenged quite strongly. The motives and aims of the operators, the attitude of the time study man to the operators and his judgement of their pace, would be found in any suggested list

(81) Yuji Ijiris op cit Pages 21-22.

(82) Ibid

of factors that are liable to be varied according to human will. More recently W.G. Allan (83) takes issue with the British Standard definition in that terms like "naturally achieve" and "over exertion" are non definitive. Dudley (84) reports on more detailed and comprehensive analyses in his references to the U.S.A. and U.K. national rating surveys. The U.S.A. survey, carried out in 1949/50 with the primary objective of determining whether the Society of Advanced Management rating films could be used as bench marks for operator performance, utilized time study engineers from a wide range of backgrounds across the U.S.A. The investigations concluded that the use of the films was a valid technique and that there was "excellent" agreement with apparently no regional differences among time study people as to what constituted "proper incentive performance."

The similar U.K. survey carried out by Matthew and the Birmingham University Work Measurement Unit in 1950/51 came to some less encouraging conclusions from the practitioners viewpoint. Complete rating forms were received from 626 work study engineers who had viewed 9 of the set of S.A.M. films previously used in the American survey but 54 sets of data were discarded because of lack of self consistency. Dudley (85) states that analysis of the data from the remaining 572 engineers showed that for the 9 jobs studied there was a 95% probability that the normal time derived from a study of five cycles by a single engineer lay within the range of + 8.54% to 14.94% (across the 9 jobs) of the value which would have

(83) Allan op cit Pages 68-69

(84) N.A. Dudley Work Measurement Some Research Studies, Macmillan 1968 Pages 8-43

(85) Ibid Pages 15-17

been obtained if the study had been taken over an infinite number of cycles. The average of these inconsistencies being  $\pm$  11.38%.

However, the average normal times for the operations in 10 main geographical regions of the U.K. showed only two regions differing significantly from an overall average of 100. On the average normal times from engineers in Yorkshire were 3.8% tight with respect to the whole country and times from engineers in the Central Midlands were 2.2% loose compared with the whole country.

These results were not widely available until they were published by Desmond (86) in 1962, meanwhile the Work Measurement Research Project Stage II (1954) had been completed. This was to discover what tolerances associated with rating were acceptable in practice by collecting data about the proportion of times which had been challenged, restudied, and adjusted from a sample of some 12,000 time study values in three factories covering 1327 workers. On the basis of the results of the study, Dudley (87) reports that it was agreed at the time that because of the very few times challenged and the very small degree of adjustment subsequently needed, time study practice was sufficiently accurate for practical purposes. A further large scale investigation into rating was carried out by Moores (88) in 1964). He found that the concept of 100 performance held by his group of 105 observers who in assessing 24 operations each at 5 different speeds generated 12,600 estimates, had a standard deviation of about 10%.

(86) D.J. Desmond The 1950 National Survey of Work Measurement Work Study and Industrial Engineering 1962 Pages 323-331, 369-377

(87) Dudley op cit Page 20

(88) B. Moores Assessment of Work Load. M.Sc Thesis UMIST 1964 Page 298

Currie (89) and Whitmore (90) describe the use of Desmonds reciprate graph as a means of work study engineers improving their rating skill. Dudley (91) suggests that the standard of time study rating practice has improved considerably since the 1950 survey because since this facility was from then on made available to practitioners, they have had the opportunity to identify and correct inconsistency and flatness in their rating. Flatness being the tendency to overrate performances which have a true value lower than 100 and under rate performances which have a true value higher than 100.

Moore's (92) is less optimistic when as a result of further analysis he suggests that the basic limitations of the rating process still exist and the flatness is more pronounced than previously acknowledged. Within companies he finds that the variation in the internal concept of standard performance, averaged across several companies is 7%, and that certain companies achieve greater uniformity amongst their observers than others, reflecting perhaps, the attention directed towards attaining it.

### 3.8 Allowances

There is agreement amongst authorities such as Karger and Bayha (93)

(89) Currie op cit Pages 48-50

(90) Whitmore op cit Pages 69-71

(91) Dudley op cit Page 20

(92) B. Moore's Variability in the Concept of Standard in the Rating Process. International Journal of Production Research Vol. 10 No.2 Pages 169-173 1972.

(93) Karger and Bayha op cit Pages 518-536

and Currie (94) et al that following the derivation of the normal or basic time a further step is necessary in order to arrive at a fair and equitable level to be regarded as standard performance.

This step is the addition of an allowance to cover the three broad areas of:

- a) Personal and Relaxation Needs
- b) Process or Unavoidable Delays
- c) Policy Allowances

Emphasis is laid on the need to determine allowances as finely and accurately as possible on the basis that the work study man goes to great lengths to arrive at fair and accurate time standards and these should not be nullified by hasty or ill considered addition of a few per cent here and there.

The difficulty of avoiding this for relaxation allowances is not minimised. Currie (95) warns trainee officers that it is a subject about which little fundamental knowledge is really known whilst Niebel (96) referring to fatigue allowances states "it is difficult if not impossible to establish values based on rational theory."

The relaxation allowance is intended to provide the worker with an opportunity to recover from both physical and mental fatigue and the personal allowance to give attention to personal needs. There seems to be fairly uniform agreement that a 5% personal allowance

(94) Currie op cit Pages 56-68 and 75-80

(95) Ibid Page 56

(96) Niebel op cit Page 357

or approximately 24 minutes in 8 hours is appropriate for typical workshop conditions for both male and female workers. Currie (97) points out that in the past it was the custom for individual work study officers to add a percentage of time to the basic or normal time for a task, in order to allow for fatigue, based on individual judgement resulting from experience. In an attempt to ensure consistency throughout I.C.I., Currie (98) produced a table of relaxation allowances which provide a guide to the determination of a percentage figure for various types of work. His table covered such separate physical factors as energy output, type of motion, visual demands, and such psychological factors as monotony and the isolation of the task from other workers. He gives as an example, a textile operation where the relaxation allowance including personal needs derived from the table totals up to 17½%. Niebel (99) quotes the International Labour Office tabulation of a similar scheme of rest allowances given as percentages of normal times and used by Personal Administration Ltd. Again for any element an allowance for each factor is awarded according to the degree of adversity of that factor.

Currie (100) and Whitmore (101) refer to blanket allowances i.e. predetermined fixed allowances covering groups of similar operations where the allowances may range from 10% for clerical duties to 30% for heavy labouring.

(97) Currie op cit Page 56

(98) Ibid Pages 66-67

(99) Niebel op cit Page 365

(100) Currie op cit Page 59

(101) Whitmore op cit Page 77

Process and unavoidable delay allowances are made to cover circumstances when output is governed by factors beyond the control of the operators such as one or more machines he is in charge of being idle until he completes his assignment on another machine. Or again, the workers output may be interrupted by the foreman giving instructions or by machine breakdowns or by tool failure. Nievel (102) indicates that there are many expressions tables and charts developed to determine machine interference, the formula most frequently quoted and according to Whitmore (103) used most effectively for more than 6 machines to 1 operator is:

$$I = 50 (1 + X - N)^2 + 2N - (1 + X - N)$$

where I = interference time as a percentage of attention time

X = ratio of machine time to attention time

N = number of machines per operator

For less than 6 machines empirically derived curves are suggested to determine interference percentages, and the situation where an operator is unoccupied during the running time of a single machine is catered for in the time study of that particular operation.

The small proportion of a worker's time which is usually taken up by minor interruptions of a casual and intermittent nature is not suitable for economic measurement by the technique of time study. The duties must be taken into account however, if the total work measurement is to be correct. The use of Activity Sampling is suggested by Karger and Bayha (104), Whitmore (105) and

(102) Niebel op cit Page 367

(103) Whitmore op cit Page 81

(104) Karger and Bayha op cit Page 529

(105) Whitmore op cit Page 36

Currie (106) as a means of assessing these irregular and infrequent interruptions to worker performance. Activity sampling, a sampling technique based on probability theory, requires a large number of instantaneous observations to be made, over time, of a group of machines, or a group of workers. The percentage number of observations recorded of a particular delay or interruption is the percentage of time that that form of delay can be expected to occur. Allowances derived from such studies appear to be around 3% to 5%.

Policy allowances are more concerned with circumstances where certain workers on incentive payments are not able to earn within the properly assessed standard time a wage which is mutually agreed by workers and management as not being sufficient. Management may then add a policy allowance for purpose of calculating wages only and as such the policy allowance is not strictly part of the work measurement process.

In terms of order of magnitude and taking the different types of allowance into account Niebel (107) quotes a survey of 42 different plants where the smallest average total allowances found in a company (household electrical applicances) was 10% and the greatest average total allowance was 35% (steel). The average total allowances being applied throughout the 42 companies being around 17%

(106) Currie op cit Page 76

(107) Niebel op cit Page 373

In considering the research and critical analyses in the field of allowances Niebel (108) reports that there has been considerable attention directed to the physiological requirements of various work situations by occupational physiologists. He does not claim that tables of allowances are based on this work but merely suggest more quantitative data will be available in the future. Karger and Bayha (109) suggest that scientific investigations have not yet produced conclusive results perhaps because of lack of interdisciplinary approach between medical and physiological science. Also that evaluation equipment needs to be developed for use in work place environments, heartrate evaluation equipment offering most promise in this direction. Dudley (110) also comments on the lack of immediate value of experimental measures of fatigue in defining relaxation allowances and that parallel to this, work measurement research should also search for improved measures of practical value. Although Allan (111) points out that subjective assessments of recovery periods have been used in formulating tables nevertheless they are a valuable guide and at best:

"allow work measurement practitioners to arrive at realistic standard times".

Williams (112) comments on the extensive investigations particularly by ergonomists which seek to validate the accuracy of

(108) Ibid Page 363

(109) Karger and Bayha op cit Pages 522-523

(110) Dudley op cit Page 34

(111) Allan op cit Page 71

(112) Harold Williams Developing a Table of Relaxation Allowances Work Study & Management Services No.7 Pages 478-483 1973

relaxation allowances and regrets that the result is mainly negative criticism which suggests that allowances are merely codified folklore:

"In spite of all their resources they have yet to make a fundamental contribution to improving the practical application of R.A."

He then publishes a revised set of tables developed from considerable efforts by a working party of the Imperial Group of Companies and tested by 12 other companies. The most significant changes in the revised tables were a fall in the relative importance of environmental factors with the importance of psychological factors remaining the same. A sample of jobs assessed by external companies using the new tables showed on average an increase R.A. of just over 1% from 16% existing and a sample of jobs within the Imperial Group showed on average a decrease of less than half a per cent on 15%.

Research and investigations into relaxation allowances sponsored by the Institute of Work Study Practitioners, particularly that by Anderson and Adler (113) at Loughborough University of Technology, has given rise to the development of revised tables and methods of calculating allowances. These include the Dickinson Robinson Groups (114), R.A. Calculator and the Institutes Recovery Allowance Data Card. Independent validation of the latter by Beal (115) suggests that use of the card produces a reasonable

- (113) Anderson and Adler "Establishment of a National Scale of Relaxation Allowances in Work Study" Loughborough University of Technology 1969
- (114) A.A. Brooks "The R.A. Calculator" Work Study and Management Services No.6 Page 202 1975 Pages 202-208
- (115) R. Beal "Human Energy Expenditure of Manual Workers in Industry" No.12 Pages 880-890 1973 (Work Study & Management Services)

estimate of energy expenditure with an accuracy of about  $\pm 10$  and that further industrially based work is needed to generate more benchmark jobs and with mixed short cycle tasks.

Some parallel work by a group of researchers in Australia and reported by Heyde (116) suggests that many tables of R.A. allowances are traceable back to the era of Bedeaux and although having great influence, their derivation and authority has never been explained. The research is developing tables which, whilst being derived from modern physiological theory and determinations, are designed for easy practical use.

The recognition of the need for allowances for delays and for recovery from fatigue as a means of converting a basic time into an anticipated worker output for a full shift is in itself a contribution to realism in a management accounting information system. The analysis of these needs and the assignment to a number scale, though still lacks a framework locked into physical science thus making a lesser contribution to the precision vector and the reliability vector of the accuracy component of an information system. There is however, some contribution to the comparability characteristic of an information system in that physical and psychological characteristics of a given level, but occurring in quite different jobs within an organisation, are included in the measurement in a consistent and uniform manner so that like is matched with like across products departments or time. If detailed tables of relaxation allowances are developed as a result of group discussion, or formulas and procedures determining machine

delays are derived mathematically there is some claim to a contribution to the objectivity characteristic of information in that they leave less to the judgement of the measurer.

### 3.9 Predetermined Motion Time Systems

The British Standards (117) definition of a Predetermined Motion Time System is:

"A Work Measurement Technique whereby times established for basic human motions (classified according to the nature of the motion and the conditions under which it is made) are used to build up the time for a job at a defined level of performance."

The definition by Karger and Bayha (118) of Predetermined Time Systems, is slightly broader in that it refers to "study and evaluation" of human work elements as well as the application of a predetermined time value and so implies the possibility of improving performance by motion analysis. They point out that systems are specifically concerned with human work and that they do not measure process time.

Based on the concept that human work activity is built up of combinations of a number of basic motions, as for example, the therblig classification identified by Gilbreth, and that each of these fundamental motions requires a constant time within practical limits, predetermined time motion systems appear to be useful in synthesising motion patterns and hence performance time for a wide variety of manual jobs. Initially these systems were more suitable for short cycle repetitive jobs but have now been extended as a

(117) British Standards Institution B.S.3138 No.31003 1979

(118) Karger and Bayha op cit Pages 35-36

means of measuring longer cycle non repetitative work.

In order to establish a job time the analyst first of all carefully examines the work cycle to ensure not only that he identifies and records all the necessary motions but seeks opportunity for refinement and improvement in the work method. Using the predetermined tables he then selects the appropriate time for each motion from the tables, taking care to select values appropriate to the nature of the motion and the conditions under which it is made. It may be then necessary if the system has values which do not represent standard performance, to apply a factor to bring the value back to standard. Once this factor is established, however, there is no need for individual ratings. Finally a percentage allowance is applied as with direct time study.

According to Mundel (119) each predetermined motion system consists of a system of notation for recording a description of the job being studied, a set of tables of time values arranged by these categories of notation and a detailed and extensive set of rules for using the tables in a consistent manner. He points out that effective use of any P.M.T.S. depends upon faithfully following these detailed rules of application, often amounting to a good sized book for each system, before attempting to apply a system.

There has been increasing development, knowledge, and use of predetermined motion time systems since the end of world war II although Whitmore (120) comments that British industry in general

(119) Mundel op cit Pages 397-398

(120) Whitmore op cit Page 116

has been slow to accept this technique of work measurement. He suggests that the most important systems used in the UK up to the late sixties were:-

- A. Work Factor
- B. Methods Time Measurement
- C. Simplified P.M.T.S.
- D. Basic Work Data

A. Work Factor was one of the earlier systems to emerge, the data being available in 1938. According to Niebel (121) this was compiled:

"After four years of gathering values by the micromotion technique, stop watch procedures and the use of a specially constructed photoelectric time machine".

The detailed Work Factor System takes into account four variables as influencing the time acquired to perform a task:-

- (i) Body Member used i.e. arm or leg
- (ii) Distance moved - in inches
- (iii) Weight moved (measured in pounds and converted into work factors)
- (iv) Manual control required such as stopping or changing direction and measured in work factors.

Motion time tables exist for each of several body members such as arm, leg or figure which show for that body member basic times for a range of distances moved. (American terminology not to be confused with basic time). For each distance moved they also showed increasing time values for an increasing scale of work factors.

A work factor has been defined as the index of additional time over and above the basic time and is the unit for identifying the effect of the two remaining variables weight moved and type of manual control.

The four manual control instances each earning ONE work factor are:-

S - Steering or directional control

P - Precaution or care

U - Change direction

D - Definite stop

Most of the basic motions or elements recognized by the Work Factor System such as reach, use, disassemble, draw on the motion time tables already described but certain motions such as "preposition" or "complex grasp" have special tables of work factor units. In order to determine standard time the analyst must take into account that time values are select times and have to be adjusted or normalised to bring them equivalent to standard performance and then allowances added to create standard times.

B. Methods Time Measurement or M.T.M. had its rules of application and other data made public by Maynard Stegmerton and Schwab (122) in 1948. It gave time values for the basic motions including reach, move, turn, grasp position disengage and release. The data were obtained from frame-by-frame analysis of films of operators working under normal industrial conditions. The data taken from the films was levelled or normalised by at least three trained engineers using the Westinghouse technique as each job was being filmed. The nature and the conditions of the motion were also found to affect the time and these were included having increased time values according to their effect. The analyst summarises all the motions that are necessary to perform the job and determines from the methods time data tables, the levelled time in T.M.Us. (1 T.M.U. = 0.00001 hour).

(122) H.B. Maynard G.J. Stegmerton & J.L. Schwab  
Methods Time Measurement McGraw Hill New York 1948

The tabulated values do not carry allowances for fatigue or other delay factors and so these allowances must be added to the times.

Simplified P.M.T.S has been developed as a self-contained technique for use in I.C.I. but is freely available and is used by a number of companies in the U.K. industry. It is based on an earlier form of detailed P.M.T.S. which itself was devised from M.T.M. According to Currie (123) the data is based on many observations of a variety of workers working on many different operations in different localities. The record of motions performed and the time taken to perform each was made by memomotion technique with each job being rated during filming by three engineers. A short but comprehensive table of data was built up with Basic Motion Times being expressed in milliminutes (one thousandths of a minute), at the standard rate of working and containing no allowances. Whitmore (124) suggests that although this system can be quickly learned and easily applied it still retains most of the features of the original system.

D. Basic Work Data is one of a number of what are referred to as second generation systems, others being M.T.M.2 and Abbreviated Work Factor. These systems have been developed to give comparable results to the original first generation but far more quickly and without sacrificing much in accuracy. (4% loss in accuracy according to Whitmore (125) and Niebel (126) from M.T.M. to M.T.M.2 on cycles over 2,500 T.M.Us). Simplification has been achieved through reducing the numbers of basic motions by such means as combination and averaging.

(123) Currie The Measurement of Work op cit Page 285

(124) Whitmore op cit Page 119

(125) Ibid 117

(126) Niebel op cit Page 438

The absence of the need for rating when analysing a job for P.M.T.S. values removes an area of subjective judgement liable to human variation which suggest that such systems would have a stronger contribution to make to the accuracy component of management accounting information systems. However, judgement is still present to some extent in the analysts assessment of the nature and conditions of the basic motions comprising the task. The systems are of course, dependent upon the corporate and averaged judgement of the original compilers.

There are internationally many different systems which have come into use over a period of time and which in part represent a refining process, however, since the various tables of motion differ there is as Niebel (127) points out, some question of their accuracy:

"In applying various published data broad differences in time values are realized on certain motion patterns".

He suggests that synthetic values are becoming more accurate as further studies are made but that there is still a need for further research, for instance, into the validity of adding basic motion times in that cycle times may vary as the sequence of therbligs is changed. He does, however, agree that the successful schemes have made some attempt to take additivity and the effect of a preceding or succeeding therblig into account. Surry (128) also finds that within M.T.M. and M.T.M.2. the interdependence of basic motions cannot be accounted for to satisfy entirely the findings of ergonomic and applied psychological research.

(127) Ibid Page 458-459

(128) R.J. Surry "Design Criteria for the Evaluation of Pre-determined Motion Time Systems" Work Study and Management Services Vol.7 Pages 496-497 1973

Dudley (129) drawing upon his own research and that of Murrel (130) and of Seymour (131) questions the compilation of some of the original foundation data in P.M.T.S. Operators on repetitive work do not naturally work at a constant rate and the pacing effect which arises from making films of operations at specified different levels of performance rating disturbs that natural pattern hence raises doubts about film based rating judgement. Furthermore, as the time of an individual motion element does not vary directly with the time to complete the whole operation, there is not much justification for the technique of rating each motion element. He consequently maintains that scientifically the techniques are invalid but the degree of error and its significance in practice is not known. Surry (132) also comes to the view that M.T.M. and M.T.M.2 do not meet ideal requirements of a scientifically valid system because they only partly take into account such factors as decision making, pacing, fatigue and the effect of repetition and related operator skill.

The lack of experimental demonstration of levels of consistency between observers to which he also refers is in part remedied by a large scale project sponsored by the M.T.M. association in conjunction with the University of Manchester Institute of Science and Technology. In this project Evans and Butterworth (133) offer a

- (129) Dudley op cit Pages 41-47
- (130) Murrell K.F.H. "Operator Variability and its Industrial Consequences" International Journal of Production Research Vol. No.3 Page 39 1962
- (131) W.D. Seymour Manual Skills & Industrial Productivity Institution of Production Engineers Journal Vol. 33 No.4 1954 Pages 240-248
- (132) Surry op cit Pages 496-497
- (133) F. Evans & J. Butterworth "A Comparison of Consistency of Time Study Observers and M.T.M.2 Analysts" Work Study & Management Services Vol.19 No.3 Pages 99-102 1975

preliminary comparison of P.M.T.S. analysts and time study observers. The subject of their study was the variation in M.T.M.2 analysis time totals by different analysts viewing the same set of films of several operations. This variation in analysis totals is comparable to variation in the concept of normal or standard rating by time study observers.

They conclude that M.T.M. analysts compare favourably with time study observers when tested under equivalent conditions. Also they have pinpointed where wide variation in analysis exists, and are involved in producing revised guide lines for analysing these areas of difficult decision. Moores (134) had in an earlier investigation used several practitioners from one organisation only, to produce collectively an M.T.M. analysis of five filmed operations and compared this with the evaluation of the filmed operations by a cross section of time study engineers throughout the country and concluded that:

"despite inherent weaknesses M.T.M. yields values comparable to those arrived at by time study."

Apart from some reservation about variable judgment from different analysts within an organisation P.M.T.S. have a strong contribution to offer to the usefulness of accounting information systems in respect of the comparability characteristic. Within the context of the use of a particular system, matching like with like across departments and processes may be expected to be done with a degree of assurance. This arises in particular through the comprehensive form of the rules and procedures associated with P.M.T.S., and

(134) B. Moores Comparison of Basic Time for Six Operations as determined by M.T.M. and Normal Time Study Methods. International Inc. Production Research Vol.7 No.2 Pages 151-157 1968

the emphasis on thorough understanding of them by analysts, is compatible with the consistency and uniformity aspects of comparability. Variations in these rules between systems and variations in their tabulated values would, of course, lessen the validity comparisons between entities across different companies using different systems.

These rules and procedures may also be said to link very closely with the objectivity criteria of management accounting information systems, a characteristic of which is freedom from personal bias arising from less judgement being necessary by the measurer. Again the mandatory notation aspect of P.M.T.S. is a form of detail which leads to the traceability and verifiability criteria of objectivity. Furthermore P.M.T.S. can claim to link with T.A. Lee's (135) view that information users will only be influenced in their behaviour if there is credibility of the process and processor. The international use of many of the systems and their particular rules may be said to give rise to a high degree of credibility in the eyes of information users. Whether Buckley & McKenna's (136) requirement is fulfilled, that the derivation of the standards must be understood by those affected, is questionable, but the data would seem to meet Arnett's (137) criteria of objectivity in that it is

- (135) T.A. Lee "Psychological Aspects of Accounting" in Accounting and Business Research Summer 75 Pages 231, 232
- (136) Adrian Buckley and Eugene McKenna "Budgetary Control and Business Behaviour in Accounting and Business Research Spring 1972
- (137) Harold E. Arnett "What Does Objectivity Mean to Accountants" in Garner and Berg Readings in Accounting Theory Houghton Mifflin Co. Boston 1966 Page 181

not dictated by managerial whim and is not derived carelessly.

### 3.10 Standard Data

Synthesis from standard data of the time required to carry out operations is a form of measuring work without carrying out time studies during the conduct of the operations or without the detailed elemental analysis of P.M.T.S. In this respect it saves the time and cost of an on site stop watch study, is quicker and permits time standards to be established in advance of production.

It is applicable to jobs in which certain individual elements may be common to a range of variation in product or process whilst other elements may not repeat themselves for some considerable time but whose elemental time has nevertheless been captured at some earlier time. Standard data are time standards that are derived from previous stop watch studies or previous P.M.T.S. analysis that have proved to be satisfactory.

The data needs to be recorded and classified in a way which will ensure understanding and which will assist the analyst to determine how long it should take an operator to perform the elements necessary to carry out an operation. The recording must be particularly thorough to enable analysts to use the data without reference to the authors of the original studies. It must be clear, for example, whether the data incorporates relaxation allowance or whether they are basic times. Data can be prepared and stored in various forms such as tables, graphs and alignment charts but care is needed not only in interpolation but also in specifying the conditions under which the values on the curve or in the tables apply.

The final accuracy of information generated from standard data time standards is still a function of the accuracy of the primary data and as such carries the same reservations applicable to that data about its contribution to the usefulness to management accounting information systems. However, as standard data are usually based on more data than an individual time standard improved reliability may arise from the tendency to reduce random errors.

### 3.11 Summary

This chapter has examined the major areas of what authoritative workers in the field consider to be the substantive body of theoretical knowledge of work measurement, together with the modifying and refining analysis of researchers, in order to assess those parts of work measurement which seemed from the analysis in Chapter II, to link with the usefulness properties of management accounting information systems. Element division and recording were seen to contribute towards accuracy and comparability. Timing methods and rating were seen within the context of the quoted critical research to contribute to the accuracy property of management accounting. The recognition of the need for allowances as part of time study was seen as a recognition of realism and as making some qualified contribution to comparability and objectivity. Predetermined motion time systems were seen as making an equivalent contribution to accuracy as time study did and as having a particular contribution to comparability and objectivity. These usefulness properties then are seen to be supported and supplemented by various characteristics which are found to be present in work measurement to a sufficient extent to indicate theoretically a positive relationship between work measurement and the usefulness of management accounting information systems.

WORK MEASUREMENT IN PRACTICE4.00 Work Measurement Practice and its Contribution to Management Accounting

Having set out the links between work measurement theory and management accounting in Chapter III, this chapter now looks at the empirical state of the technique as perceived by various observers. In doing so it seeks to check for the presence of these link characteristics and to search for others which may be there in practice. The applicability of work measurement to small business units is also considered.

The chapter examines the state of organisational practice and current perception of the technique of work measurement, its parameters and sub systems. By reviewing widely based field research and investigations it seeks to clarify the manifestation work measurement takes in organisations who may be regarded as "users" of work measurement. In scanning the empirical scene it first searches for the presence, within this manifestation, of factors identified as theoretically linking with accounting information systems. It also searches for the presence of common properties or characteristics which although not brought into sharp focus in theoretical texts, nevertheless are seen as relevant to a complete manifestation of work measurement.

The review proceeds by considering work measurement as a technique resource with various sub units each of which management is using to various levels or degrees. The extent to which this resource exists in its various sub units has been assessed using comparable

measures such as types of techniques used, the form of training undergone by practitioners, and their degree of experience, by such researchers as Swann (1), Bevis & Collier (2), and Minter (3) in this country and by Reuter (4), Barnes (5) et al in the U.S.A.

#### 4.1 Systems

The identification of separate systems and sub systems of work measurement is reasonably consistent by these different investigators and these can be summarised as being: Time Study; Activity Sampling (rated or otherwise); Pre-determined Motion Time Systems; Synthesis from Standard Data; Analytical Estimating; Production Studies. Bevis (6) notes that a large majority of industrial establishments on repetition production in the U.K. and U.S.A. use time study as a means of determining performance and that P.M.T.S. has also received an increasing measure of acceptance in recent years. Bevis (7) whose research into the effects of the learning curve on worker performance directed him to an interest in timing devices comments:

"In British industry the stop watch is still the most used piece of time measuring equipment."

- (1) K. Swann Management Attitudes and Techniques in the Small Company. Unpublished Thesis, University of Bradford 1971
- (2) F.W. Bevis & P.I. Collier. An Industrial Survey of Work Study in Wales 1963-65. An unpublished paper. Welsh College of Advanced Technology.
- (3) A.L. Minter. A Critical Analysis of Work Study. Unpublished thesis M.Sc. University of London 1967
- (4) V.G. Reuter Work Management Practices California Management Review 1971 Part 14 Pages 24-30
- (5) R.M. Barnes "Industrial Engineers Survey - 1967" The Journal of Industrial Engineering XVIII:12 December 1967 Page 14
- (6) F.W. Bevis "An Exploratory Study of Industrial Learning with Special Reference to Work Study Standards" Unpublished MSc Thesis U.W.I.S.T 1970 Page 3
- (7) Ibid Page 12

In their survey of Work Study in Wales, Bevis & Collier (8) found that of the companies using Work Study, 94% practised time study, 70% activity sampling, 15% P.M.T.S., and 77% synthesis from standard data. Minter (9) reporting on his 1965 survey of members of the Institute of Work Study Practitioners, implies that 96% of those responding were practising time study and states that 70% were using activity sampling, 73% synthetic data, 38% analytical estimating and 23% P.M.T.S. In a survey of 55 companies and organisations whose employees totalled over 100,000, Longhurst and Kerridge (10) found similar percentages for time study and activity sampling but slightly lower percentages for analytical estimating and P.M.T.S. with "Data from other sources" as 27%.

#### 4.2 Rating

The percentage use of different rating scales such as 60/80 - 0/100 100/133 has been found to vary considerably from one survey to another, particularly where a time gap separates the surveys. The B.S.I 0-100 scale was being used by 20% of firms in the Bevis & Collier (11) study by 50% of Work Study engineers in the Minter study (12) whilst Longhurst and Kerridge (13) in the second half of their study found 79% of companies using the B.S.I 0-100 scale. The use

(8) Bevis & Collier op cit Page 14

(9) Minter op cit Page 4

(10) B.J. Longhurst R.G.P. Kerridge The Application of Work Measurement in Industry. Work Study & Management Services March 1972 Pages 126-129

(11) Bevis & Collier op cit Page 23

(12) Minter op cit Page 4

(13) Longhurst & Kerridge op cit Pages 127-128

of different scales of rating by different companies is also a feature of the American Industrial Engineering practice. Almost no companies were found to be operating without rating scales.

#### 4.3 R.A. Allowances

Relaxation or compensating rest allowances are again based on a number of alternative means practised by companies. Bevis & Collier (14) found that over 50% used allowances either supplied by consultants or compiled from books and other references and a further 25% from book references only. They comment that a large percentage of firms compiled tables based on element or component analysis but that otherwise a blanket value was applied which covered most operations in a given department. Minter (15) found 62% of practitioners using detailed rest allowance tables, and fixed or arbitrary allowances were used by 22%. According to Dudley (16) many industrial companies have established compensating rest allowances which work empirically. Although often challenged they are acceptable in principle and appear in practice to be present as a component of standard times and work unit values.

According to Allan (17) in spite of inconsistencies, tables of allowances are a valuable guide to practitioners in arriving at realistic standard times. He quotes a paper presented by Humble at the European Work Study Conference in Paris of 1965 in which Humble found several differences of approach including offsetting

(14) Bevis & Collier op cit Pages 127-128

(15) Minter op cit Page 4

(16) N.A. Dudley Work Measurement - Some Research Studies Macmillan 1968 Page 31

(17) W.G. Allan Work Study and Worker Remuneration. Unpublished Thesis MSc University of Strathclyde 1970 Pages 71-73

tea breaks and washing off times against allowances; some allowances being conditioned by performance rating in contrast to the view and practice that there is no interplay. Some practitioners follow the convention of determining an allowance for each element whilst others taking into account the lack of scientifically developed knowledge of fatigue settle for an overall allowance.

#### 4.4 Practitioner Training and Selection

Use of the technique resource of work measurement cannot be considered solely in terms of the above separate techniques practised by companies. The question arises in practice, though hardly posed in authoritative texts, as to the level of competence exercised by practitioners who are using the techniques and one component of this competence is the training undergone by the practitioner. Reuter (18) draws the conclusion from a study of work measurement utilisation, that for the conduct of their work study programmes:

"Most organisations recognise and believe that such a programme requires special skills and training."

He points out that any view existing that American college trained Industrial Engineers require no further training is nullified by the fact that most firms do offer such training programmes. He found 62% of companies (size range 0 to 2000+ employees) in his work measurement study of California and 72% of companies in his New York State study had conducted courses in work measurement techniques for their industrial engineers.

(18) V.G. Reuter Staffing and Training for Work Study Personnel Journal (US) Feb. 1971 Pages 144-150

Bevis and Collier (19) found that 64% of the companies in their survey arranged courses in work study and that of these 80% used external facilities either in whole or in part. When surveying work study personnel as individuals, of their sample of 180 from 44 establishments, they found that less than 2% had received no training, that 12% had been trained by industrial consultants, that training for the remainder was divided more or less evenly across Work Study Schools, Technical Colleges, and in-company courses. Training in the main appears to consist of short full time or sandwich type courses varying from 3 weeks minimum ranging up to 3 months duration of specialised work measurement study and some evening classes such as City and Guilds and I.W.S.P. which extend over a longer period.

Longhurst and Kerridge (20) found when analysing the implementation of incentive schemes that less than 5% of companies were using staff NOT trained in work study, and in comparing the 1960-69 decade with previous years found an increase in the extent to which consultants were used in the implementation of incentive schemes. The conclusions they drew from this include two which emphasise the importance of training for the user of work measurement techniques viz. that there was a shortage of properly trained and experienced work study staff available to companies and that companies were taking the opportunity to give their own staff training under the guidance of consultants.

(19) Bevis & Collier op cit Pages 37-39

(20) Longhurst & Kerridge op cit Page 128

#### 4.5 Recruitment Parameters

Is there any common recruitment policy followed by companies using work measurement in selecting people for work study jobs or for training? Two of the significant trends found by Bevis & Collier (21) were that 64% of companies recruited work study practitioners from foremen, supervisors and ex apprentices and a further 20% rely on personnel already trained in work study. In terms of the survey of individuals they found that 83% of practitioners had industrial experience prior to doing work study.

In terms of general academic background, Bevis & Collier (22) found that less than 5% had a City and Guilds Final Examination and under 7% had O.N.C. or O.N.D. Whilst 13% had H.N.C. or H.N.D. a university degree was held by only 5%. Reuter (23) quotes Barnes (24) study findings that 46% of people in industrial engineering departments held an industrial engineering degree compared to a median figure of 35% having degrees found in his own California study. The higher American figures would seem to be influenced in part by the comparatively greater opportunities for higher education in industrial engineering which exist in America. In the UK the H.N.C. H.N.D. and degree qualifications together amount to less than 20% which suggest that academic background is not a significant factor in the recruitment policies applied to work study staff.

Although a very large percentage of work study personnel undergo training the extent to which they possess some qualification in

(21) Bevis & Collier op cit Pages 37-40

(22) Ibid Pages 37-40

(23) Reuter op cit Page 146

(24) Barnes op cit Page 14

work study is very limited, less than 5% of the Bevis and Collier (25) sample of 180 were reported as having a certificate of the Institute of Work Study Practitioners or a City & Guilds Work Study Certificate. These figures are not inconsistent with the much higher percentages who have been trained, as training in the main consists of the short full time or sandwich type courses which do not exempt participants from City and Guilds and I.W.S.P. examinations. The latter are usually taken after a prolonged series of evening classes.

Again membership of professional institutions by their practitioners does not appear to be a part of the normal manifestation of use of work measurement by companies. Bevis & Collier (26) also found less than 11% of personnel to be corporate members of the Institute of Work Study Practitioners and about 3% to be affiliates of the Institute, Minter (27) speculated that perhaps one practitioner in five was a member of the I.W.S.P.

#### 4.6 Work Measurement Experience

What length of experience do users of work measurement consider to be appropriate for regarding a person as a competent practitioner in work measurement? Reuter (28) quotes Hannons (29) questionnaire study with over 1600 respondents answering the question:

(22) Ibid Pages 37-40

(23) Reuter op cit Page 146

(24) Barnes op cit Page 14

(25) Bevis & Collier op cit Pages 37-40

(26) Ibid Page 40

(27) Minter op cit Page 3

(28) Reuter op cit Page 147

(29) I.W.Hannon A Fresh Look at Industrial Engineering. The Journal of Industrial Engineering Vol. XIX 5 May 1968 Page 11

"How long does it take for a typical new Industrial Engineering Graduate to become a proficient contributor to Industrial Engineering Work".

64% indicated that a period of one year or more was required.

Reuter (30) comments that the work appears to be sufficiently complex to require considerable experience even on the part of college graduates specifically trained for this type of work.

Bevis & Collier (31) found that over 70% of 117 respondents to their questionnaire had two or more years of work study experience.

They noted that the trend in their figures was indicative of an increase in recruitment, which might change slightly the two years percentage in the future. The authors of Training for Work Study Practice (32) after consulting industrial training boards, the Institute of Work Study Practitioners and Department of Employment, concluded that the rate of intake of Work Study engineers appears to be in the region of 10% to 12% yearly against an annual wastage of about the same figure with little if any actual growth in the number of persons employed in work study practice. Thus at any given time at least 75% of practitioners have two or more years service.

Consequent upon these surveys and observations, it seems that within user companies, a period of not less than two years of experience of work study is required for the practitioner to be considered as included within the large majority of his colleagues as far as length of service is concerned.

(30) Reuter op cit Page 148

(31) Bevis & Collier op cit Page 39

(32) Department of Employment - Training for Work Study Practice HMSO 1971 Page 11

#### 4.7 Work Measurement in the Small Business Unit

Having reviewed work measurement in practice in general, it is appropriate at this point to review the practice of work measurement as manifest within the sector of the small business unit and consider its applicability in this area. Some indication that the use of work measurement is not confined to medium and large companies is to be found in Reuters (33) widely based investigation into the status of work measurement. The three locations chosen for the study, Phoenix (Arizona), Rochester (New York) and Los Angeles, all contained a preponderance of smaller firms which had to be catered for in the design of the study. The use of the technique by small companies can be inferred from his table of company size classification which he used for the comparison of some of the detailed practices of work measurement. The classification is not solely concerned with companies above 500 employees, but includes two groups, 0-250 and 250-499 employees for analysis purposes.

In the survey of work study conducted throughout the principality of Wales by Bevis and Collier (34) in 1963-65 the proportion of firms found to be using work study increases from 14% of companies in the 51-100 employee size group to just over 30% for companies having between 201 and 500 employees. As 94% of firms used work measurement as part of work study, these proportions may be reasonably taken as close indicators of the use of work measurement. In the 201 to 500 size group, detailed analysis indicates that the degree of formality in the use of the technique is mainly similar to that found in larger companies.

(33) Reuter op cit Pages 24-30

(34) Bevis & Collier op cit Page 9

The authors of Training for Work Study Practice (35) expressed the view that the majority of small firms do not make use of work study but that there is potential for its useful employment in such firms. It suggests that although some small firms may be unwilling to use work study, the reason for them not using it is likely to be that they are not aware of the benefits that can arise from its proper application in the small business sector.

Swann's (36) quantitative investigation in 1970/71 into the use of management techniques by small companies in Yorkshire made a comparison between companies in the 20/99 employee size group with those employing between 100 and 499. Although only 20% of companies in the smaller size group were using work study, this figure increases to 60% in the 100-499 employee size group. In his list of techniques which includes management accounting, production planning and operational research, work study is first in rank order as far as utilisation is concerned.

In a study in a different area, the south of England, Longhurst and Kerridge (37) made a random selection of 100 companies known to have a work study or similar department. Of the 55 companies who responded to a questionnaire concerning their detailed use and application of work measurement, just under 25% were in the 50 to 100 employee size group.

These research reports indicate that in practice the technique of work measurement is fully applicable to small business units

(35) Department of Employment op cit

(36) K. Swann op cit Page 11

(37) B.J. Longhurst R.G. Kerridge op cit Pages 126-129

and that a sufficient proportion of small units are using work measurement to make the small business environment a viable area in which to conduct research into its relationship with management accounting.

#### 4.8 Summary and Conclusions

Reviewing those aspects of work measurement found in practice which have a link with management accounting information systems it is seen that time study is in use by almost all companies who maintain they are users of work study and the stop watch is regarded as the most frequently used timing device.

The use of rating by work study users was varied in the detail of which particular rating scale they used but it was found that almost no companies operated work measurement without rating. The relaxation allowance component of work measurement was again a varied picture. Although not finding such complete utilization as rating, compiled tables of relaxation allowances from various sources were used by a considerable majority of companies with on average less than a quarter of companies apparently making no use of allowances. Again, a large proportion of companies made use of synthesis from standard data but less than a quarter were using some form of P.M.T.S.

The systems generally in use then, by user companies, have the potential to contribute to the accuracy comparability and objectivity properties of management accounting information systems by their use of time study and its implied requirement of elemental identification and recording, by rating and to some extent, by allowances for relaxation and contingencies. In addition to these systems

characteristics which were in sharp focus in theoretical texts, there are other characteristics found to be consistently present within the manifestation of work measurement which link in with accounting information systems. The extent to which practitioners in user companies have undergone training (only 5% of companies were using staff not trained) holds out a higher expectation that the procedures and techniques of work measurement which have been shown to contribute to accuracy and comparability will be carried out in practice. The development of skills necessary to this end seems to be associated with practitioners (some 80% of them) having had some form of industrial experience before embarking on work study. This earlier industrial experience, coupled with the amount of actual work study experience that most people possess, usually at least two years, increases the credibility of the practitioner as an information processor and this supports the objectivity property. In that objectivity is affected by the skill of the measurer, it is also supported by the training characteristic. The lessening of personal bias arising from acquisition of knowledge of rules and procedures to replace judgement also tends to support objectivity.

This examination of the empirical investigations into work measurement has also indicated that the technique is applicable to and is used by small businesses. As management accounting has likewise been identified within small firms, the way is open for an exploration of the relationship between the two techniques within the setting and context of small businesses.

CHAPTER VRESEARCH DESIGN AND TESTING

5.00 Having, in the earlier chapters, developed theoretical links between management accounting information systems and work measurement, through the examination of theoretical knowledge and empirical investigation, the first part of this chapter considers the general but relevant concepts of research design and testing. Then taking into account these concepts and their associated requirements, hypotheses are formed which postulate relationships between work measurement and management accounting information systems. Again using the general concepts of research methodology, a particular pattern of constructs is then formulated and defined which comprises the framework for the testing of the hypotheses. The sampling strategy is then developed by evaluation of different sampling possibilities with the choice of the Furniture and Timber Industry emerging as the field of empirical investigation, together with the use of an interview schedule technique as the means of data collection.

5.1 Nature of the Research

The nature of the research is in general, concerned with the association of variables together with some exploratory investigation of phenomena.

Seltiz (1) would classify the association of variables as descriptive and refer to its purpose as:

(1) Claire Selltiz etal Research Methods in Social Relations  
Methuen Revised edition 1959 Page 50

"To determine the frequency with which something occurs or with which it is associated with something else (usually, but not always, with a specific initial hypothesis)".

She suggests that the purpose of formulation or exploratory studies is:

"to gain familiarity with a phenomenon or to achieve new insight into it, often in order to formulate a more precise research problem or to develop hypotheses."

Oppenheim (2) refers to the association type of research as an analytic, relation survey, whose purpose is to :

"explore the relationship between particular variables... It is less orientated toward representation and more towards finding associations and explanations, less towards description and more towards prediction... Like experiments in the laboratory, it is usually set up to explore specific hypotheses."

Drawing upon the Issac and Michael (3) form of classification, this research would be considered a combination of case study research and correlational research. Selltiz (4) points out that in practice, different types of study are not always sharply distinguishable and that they may have two or more elements of the different functional criteria with perhaps one having the prime emphasis; in this case the emphasis is on the association of variables. This investigation of the extent to which variations in one or more factors relate, is correlational and is not seeking to establish cause and effect relationships by either causal comparative, or experimental research.

- (2) A.N. Oppenheim Questionnaire Design and Attitude Measurement - Heinemann 1966 Page 9
- (3) S. Issac W.M. Michael Handbook in Research and Evaluation Knapp, California 1972 Page 14
- (4) Selltiz op cit Page 51

## 5.2 Testing

A system for the testing of technical and behavioural hypotheses is referred to by the Committee of Internal Measurement and Reporting of the A.A.A. (5). It suggests the need for a total research strategy as a means of testing the hypotheses. This strategy has a number of steps each of which assumes an answer to the question of the previous step. This step framework, although summarised below in linear form, is regarded as a loop around which research in a given area may pass a number of times:-

- 1) The Idea - an idea exists and requires additional steps for testing its validity.
- 2) Theory Building - Propositions - Hypotheses - theories and specific hypotheses to be tested serve as the departure platform for the methodological constructs of the research.
- 3) Data Gathering Approaches - The testing proceeds by means of gathering data to be used in examining the assertion in the hypothesis.
- 4) Analysis of Data - the data gathered serves as the raw material for examination either statistically or by non-statistical models.

In this research the basic ideas and theories were explored in Chapters I to IV leading to hypothesis and construct identification later in this chapter. Data gathering approaches are dealt with in this chapter, Chapter VI (which includes further construct development) and in Appendix A. The results are examined and conclusions drawn in Chapters VII through to XI

- (5) American Association Committee on Internal Measurement and Reporting. The Accounting Review Supplement to Vol XLVIII Page 216 1973

### 5.3 Measurement and Design

Decisions on precisely what to measure, how measurement is to be carried out and on whom, can best be arrived at by first examining the concept of measurement in research.

Selltiz (6) suggests that the quality of research depends not only on the adequacy of research design but also on the "fruitfulness of the measurement procedures employed". Measurement and research design would appear to be closely interrelated in that meaningful measurement is dependent on sound construction of the research question and on clear concepts. It is necessary, therefore, to consider carefully the decision of what it is the research requires by way of measurement. On the other hand, an early recognition of the limitations and constraints surrounding the measurement of the functions the researcher may initially wish to include may amend the research design towards a sounder and more acceptable enterprise.

### 5.4 Variance Control

Although he was referring to experimental and research situations Kerlinger (7) comments about control in research having a fair degree of applicability to design and its relationship with measurement in other forms of research. He suggests that control of three kinds of variance is necessary if answers to research questions are to be valid:-

(6) Selltiz op cit Page 146

(7) Kerlinger Fred N. Foundations of Behavioural Research.  
New York Holt Rinehart & Winston Inc. 1973 Chapter 17.

## 5.5 Validity

The gathering and measuring of data by questionnaire techniques requires consideration of the quality of such a measuring device. One main characteristic of a measuring instrument is its validity or the extent to which the device measures the characteristic intended. Does it measure what it is supposed to measure?

Do the data or scores reflect the differences of the characteristics one is seeking to measure or are they indicators of some other state or condition?

It is possible to gain some indication of the validity of the data collection method by a form of cross check or comparison with a second and independent source of information such as some complimentary clerical record, or as in this research, the detailed records of the work measurement of a number of tasks, as a check on the separate measures of the use of work measurement. Such an independent check of the measurement of a variable is referred to as a criterion. Another example of a criterion would be to take a known situation, such as the overall state of the management accounting information system in a particular organisation, and check the response of a person to questions about the component parts of that situation. The use of criteria which is sometimes known as pragmatic validation has limitations however, particularly where attitude type questions rather than factual questions are concerned. The difficulty arises mainly because of lack of suitable criteria in the form of groups of people with known and different attitudes towards a situation in order to provide an indication of whether or not the questionnaire can discriminate between them. Given this limitation, validity can be supported by having a good rapport with the respondent so that he is willing to co-operate, is

in a mood to give information that is accurate, and also that he responds with candor rather than with stereotyped answers.

### 5.6 Reliability

Having considered the extent to which a measurement procedure is sensitive to the differences in the characteristic being measured, the reliability component of the quality of the measurement device is now looked at. The reliability of a measurement procedure is the extent to which variation in scores among subjects arise not from differences which exist but from inconsistencies in the measurement process. Results from a measuring procedure of high reliability will have fewer random errors. Such a procedure will be a more stable device in that repeated applications of the measurement instrument to an identical object will record the same result. Where different observers are using the same instrument at the same time they will be recording equivalent results.

Practical possibilities and resources available for development of measurement procedures restrict the achievement of maximum reliability but it can however, be improved with care. With factual type questions internal checks can be built into the questionnaire by asking the same question in a different form. Inconsistency by respondents would point to question wording, its position, or context being faulty. Where attitude is concerned, it is not possible to improve reliability by asking the same question in another form - it is now a different question. Both different questions forming a set in relation to an attitude situation such as participation and the use of attitude scales, are however, useful aids to reliability when opinion is being canvassed. In such instances vagaries in question wording will probably be self cancelling and a more consistent record of the underlying attitude emerge.

### 8.1.2 Comparability

That property of management accounting information classified as comparability is concerned with the facility of information to enable the decision maker to match like with like in terms of entities such as cost centres, or jobs or time periods. Decision makers were asked to what extent they found the assessed figures in the operating statements to be a reliable guide when comparing one job with another or one time period with another in terms of direct labour activity. The responses were coded to give comparability indices in which higher scores indicate higher levels of comparability.

Table 12 shows the results of responses about the comparability of one job to another. 80% of decision makers thought the information was "often reliable" or "very often reliable" (scores 7 to 10) in comparing one job with another whereas only 35% of the NON USE group had the same perception. 43% of the latter thought the information "sometimes reliable" (score 5/6) and some 20% viewed it as being "seldom reliable". No-one in the USE group perceived the information as being "seldom reliable" and only 19% viewed it as being sometimes reliable."

With a median comparability index of 9 the USE group perceived the management accounting information to be a more reliable guide when comparing jobs than did the NON USE group with a median index score of 5.6. The difference between the job comparability index at the USE/NON USE groups is significant at  $p .01$  based on the Mann Whitney U Test.

Just as the reliability of an engineering fine measurement instrument is increased by controlling the environmental conditions, such as temperature and humidity, the measurement of human perception of a property or of an attitude can be made more reliable by paying attention to irritants such as noise or other disturbance when applying the measures to the various subjects. Variations in the administration of measures can be controlled and minimised as a means of avoiding such disturbance and of improving reliability.

### 5.7 Hypotheses

Following this examination of various concepts of research design and testing, together with their requirements and limitations, it is now feasible to draw on the earlier development of the theoretical link between work measurement and management accounting information in order to formulate hypotheses.

In this research, the role of management accounting as an aid to decision making by managers and supervisors, was explored and clarified in sections 2.1 to 2.3. Properties and criteria of management accounting systems considered to be beneficial and useful to decision makers were then identified in sections 2.5 to 2.8 and those likely to have an association with work measurement grouped into the sub-classifications of: usefulness; accuracy; comparability and objectivity. Also the nature of these properties was examined and this enabled theoretical links to be traced across the interface with work measurement between them and particular criteria and sub-divisions of work measurement which were seen as reinforcing and enhancing them. Other properties of management accounting information systems were noted as having some influence on decision makers but examination of these properties was deferred.

as they were not seen to be associated directly with work measurement and as such were regarded as external variables.

The origin and development of several and various elements of work measurement were then examined in detail in Chapters III and IV in order to critically assess their nature and the validity of their contribution to management accounting properties as originally postulated and further clarified in sections 2.5 to 2.8.

This investigation and analysis of existing knowledge from the standpoint of the original research idea has revealed the theoretical existence of a positive association between work measurement and management accounting to a sufficient extent to allow the formulation of a hypothesis which could be tested in order to assess the validity of the relationship. Taking into account the generalised views of research design and testing and recognising the constraints of measuring various functions within the research idea, the following hypothesis was formulated:-

"There is a positive relationship between the USE of Work Measurement and the perceived usefulness of Management Accounting Information by decision makers."

There are likely to be differences in the perception of the usefulness of management accounting information, between decision makers on the one hand, and accountants on the other, not merely because they are fulfilling different roles, but because, as Hilal (8) points out, a great deal of the literature and research

- (8) I.M. Hilal The factors affecting cost control by shop floor management in the British Iron & Steel Industry. Unpublished PhD Thesis - Manchester University 1967 Pages 3 & 4.

work about accounting information has been compiled by accountants, whose views and conclusions may have been in an unintentional way, conditioned by their roles. Accordingly, it would increase understanding of the relationship between work measurement and management accounting systems, if, in given situations, the accountants perception of the relationship was also tested by way of comparison with that of decision makers. To this end an additional hypothesis was formulated:-

"There is a positive relationship between the USE of Work measurement and the perceived usefulness of Management Accounting Information by accountants".

#### 5.8 Summary of Constructs and Variables

In order to convert the general principles of research methodology referred to earlier in this chapter into a model for testing these hypotheses a number of constructs are now proposed which, when composed in a structural set of different types of variables, create a model or framework of measurement for the purpose of testing.

These constructs and the type of variable they become in this research, are set out in a simplified structural composition in Fig. 1, which, together with a summary definition of each of these constructs, indicate the basis of a sampling strategy. Some of the constructs are based on expositions found in Chapters II, III and IV, or later in this chapter. Others will be explored and developed in Chapter VI where the variables of each construct in turn, are extended through to a means of measurement by particular items of a questionnaire.

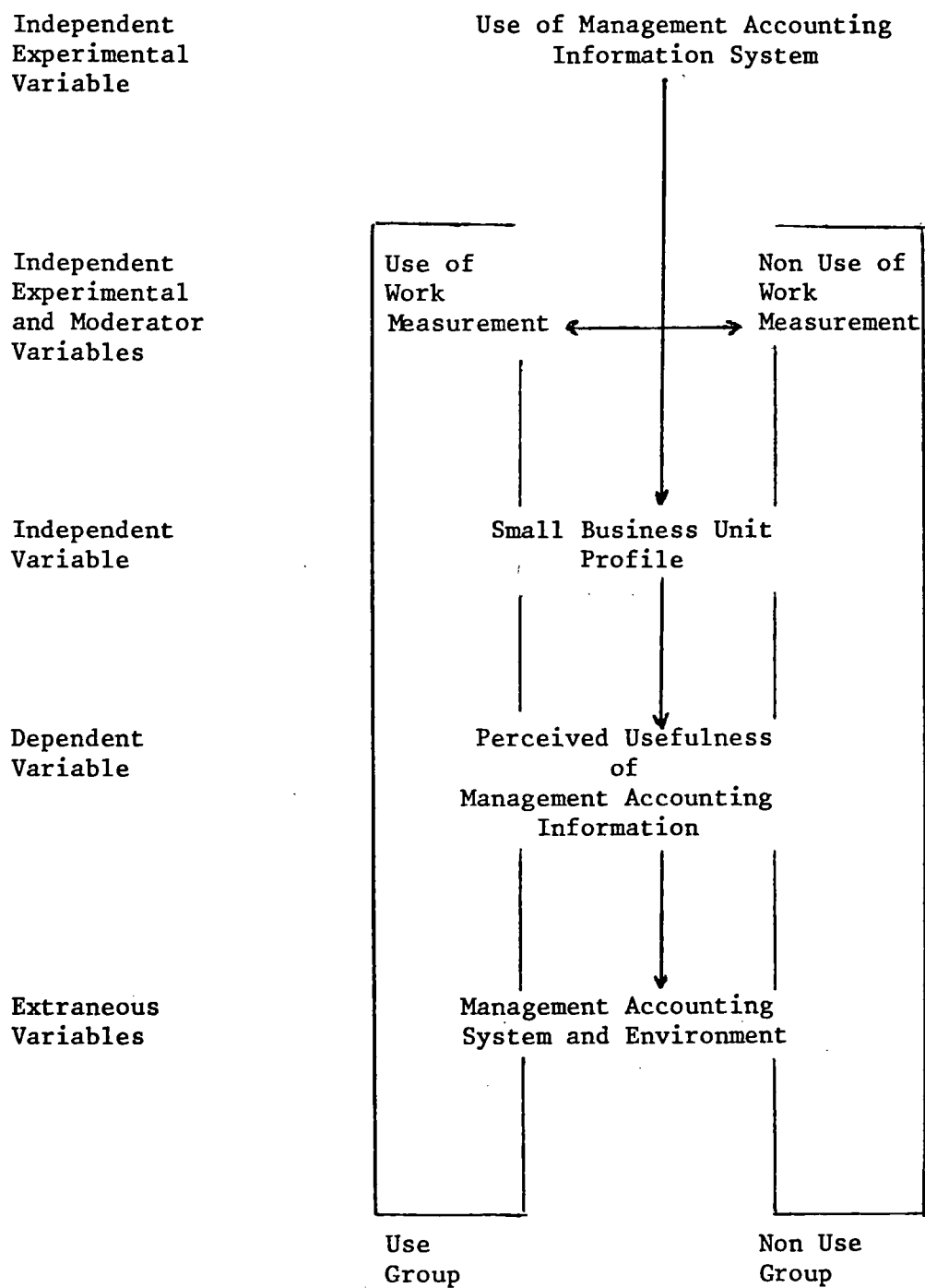


FIG. 1

RESEARCH STRUCTURE

### "Use of Management Accounting Information Systems"

This first construct, an independent and experimental or manipulative variable is used as a parameter for determining whether or not a small business is a user of a management accounting information system for the purpose of this research, and includes such factors as roles, functions, methodology and experience of accounting systems. This construct is based on expositions in Chapter II and is developed in Section 6.1.

### "Use of Work Measurement"

This construct refers to the state of work measurement practice in a small business unit and as part of the independent experimental or manipulative variable is used to determine whether or not to include a given small business in the research as a user of work measurement. As part of the experimental variable it aims to emphasise differences in the groups of small businesses studied by its concern with appropriate levels of training, experience, methodology and application of work measurement. The construct is extended to draw out some additional states which as moderator variables may affect the hypothesised relationship. Based on expositions in Chapters III and IV this construct is developed in Section 6.3.1 and 6.3.2.

### "Non Use of Work Measurement"

This construct refers to the state of practice where work measurement is not used in a small business. As the other part of the independent experimental variable designed to emphasise group differences, and again extended to classify additional states as moderator variables, the Non Use of Work Measurement construct is used to determine whether or not to include a small business

in the research as a Non User of Work Measurement. In order to maximise the experimental variance this Non Use classification does not necessarily include those businesses which do not warrant a Use classification but will contain only those businesses where distinctively separate methods of assessing direct labour are used such as estimation by experience, sales value, or historical records. The construct is developed in Sections 6.4.1 and 6.4.2.

#### "Small Business Unit Profile"

This construct refers to that state of a small business unit in relation to such features as products, mode and technology of production or ratio of labour to material costs. As an independent but not experimental variable its aim is to assess industrial comparability between those small business units actually used in the testing of the hypotheses. This construct arises from an exposition in a later part of this chapter, Section 5.10 and is developed in Section 6.5.

#### "Perceived Usefulness of Management Accounting Information"

Having established the independent experimental variables this construct, the dependent variable, is the other main sector of the hypothesised relationships. It assesses the actual level of the constituent characteristics of usefulness i.e. accuracy, comparability and objectivity as perceived by decision makers and accountants in the two groups of small business units. This construct arises from Chapter II and is refined in Section 6.6.

#### "Management Accounting System and Environment"

This construct refers to additional properties of the management

accounting system itself, such as timeliness, and to characteristics of the environment in which the system operates, such as participation or superior subordinate relationships. These components of the construct become those extraneous or unwanted variables in the research design which might have a direct influence on the dependent variable in such a way that they would tend to cancel or confound the effect of the independent variable. By way of attempting to assess whether the strength of this construct as measured, has had any effect on the perceptions of the management accounting information as a whole, a check variable concerned with the perceived usefulness of management accounting information about raw material issues is introduced. This construct is fully explained later in Section 6.7.

#### 5.9 Sample Groups and Comparability

Using this proposed framework of constructs and variables a sampling strategy is now developed for the testing of the hypotheses.

An original objective of the research was that any results emerging from the work would be as representative as possible of the small company sector of industry. The first intention then was to carry out empirical observations in companies in the 100-499 employee size range who were spread across different industries in the North East in order to yield samples of companies representative of a wide industrial environment. The 100-499 employee size group is one used by Swann (9) in his survey of the use of management techniques

(9) K. Swann "Management Attitudes and Techniques in the Small Company" Unpublished Thesis University of Bradford 1971

by small companies and seemed a suitable size range for this research. To have extended the range downwards to include companies having from 20/99 employees would seem unproductive in view of the much fewer companies in this range found by Swann (10) to be using work study or management accounting techniques. In the researchers casual and limited experience there seemed to be a critical mass point of round about 100 employees which made the use of the techniques a decision to be realistically considered by small businesses. Associated with this first intention it was originally proposed that a postal survey of some 300 companies would be carried out in order to find a group of companies all of whom were using a management accounting information system. The independent variable use/non use of work measurement would be used to generate from this latter group, two dichotomous samples each of about 25 companies, one sample comprising companies classified as users of work measurement, the other comprising companies classified as non users of work measurement.

Reference was made in section 5.4 Variance Control to factors other than the independent experimental variable which might influence the behaviour of the dependent variable. The question now arises as to whether any such additional influences might result from the selection of companies to be observed and measured in that such influences might derive from the particular technology of type of production being pursued by individual companies. Different technologies might have marked differences in the ratio of capital costs to labour costs or labour to raw material costs which could affect the view of the usefulness of management accounting information.

A company operating one form of technology such as precision machining of one off and small batches of medium sized engineering items, or a mineral water manufacturer may have an inherently different or biased view of management accounting information from a labour intensive manufacturer of cheap textile garments or a maker of plastic tarpaulins and covers.

In order to minimise the influence of such uncontrolled variables it was necessary to consider the possibility of conducting the survey amongst two comparable subject groups. The groups would be comparable not only in their common use of management accounting but would need to have reasonably common characteristics of technology, production and market environment. It would be desirable for companies in both groups to have similar ratios of capital cost of material cost to labour cost and for the total order process time to be neither excessively short, as with confectionery products nor to extend to periods of many weeks as might arise with some metalurgical or fabrication processes. The shortness of both the individual operation time and the order process time of the former might result in high levels of aggregation of data not appropriate to the use of work measurement and in the latter instance, the long process time might mitigate against the use of work measurement and also of management accounting for controlling activity over such periods as a week or one month. It would also be desirable to avoid wide variations in competitive market pressures on internal cost efficiency.

This planned coverage of a widely representative sample of small companies was seen then to present some difficulties of measurement and of design. The structure of the research design rests firmly

on the maximisation of the experimental variance use/non use of work measurement and with a wide ranging postal survey there might be a lack of certainty as to whether the questionnaire to measure this variable was completed by the proper person or instead had been filled in by the owner or managing director. The same reservations might be held about ascertaining whether or not a company was using a management accounting information system.

Two requirements of research design emerged as not being satisfied in this plan. First of all consideration of the need to ensure like was being compared to like except for the experimental variable might throw doubts on the research results themselves if within or between the two groups there were marked divergencies in technology or production. Furthermore the possibility of some practical use of the results as an aid to a company in the decision process of opting to use work measurement could be lessened. Such a decision maker might feel that the results were confounded and influenced by several different technologies and products to an extent which rendered him unable to transpose and marshall the results in order to aid his own decision. Again judgements about the need to exclude a particular company on the basis that its technology, type of product or production made it lack comparability within or across the groups would raise questions of validity. Without considerable development of suitable measuring devices, such a methodology of selecting companies would give rise to the probability of bias in the samples. To use randomization as an alternative means of taking care of differing technologies and types of production, would require samples which might be too large to be measured in the research time available.

In seeking to overcome these difficulties, ideas developed away from using a wide variety of small business to using companies from just two or three industrial classifications such as steel fabrication, light engineering or textile manufacturing. This led on to the suggestion of conducting the empirical investigation in small business units in just one industry. To conduct the field investigation within one industry where the technology and type of production were not too dissimilar would contribute to effective measurement of variables in that like was being compared with like apart from the designed independent variable and that there was less likelihood of working with biased samples.

The size of the two sample groups would of course be smaller, probably about 10 in each group, if the investigation were conducted in one industry. On balance however, it seemed that more viable results would be obtained from smaller groups with a higher degree of comparability than with larger groups more likely to have in, and between, group diversities. With the implicit approval of an industrial association and by adopting the smaller groups, the opportunity would be available for more personal penetration into each company as a means of securing the comprehensive data needed for the several variables. To go in the other direction and increase the sample groups to allow randomization to take care of comparability would require the researcher to use limited available time in desk management of postal questionnaires. This would not take advantage of what was considered by the researcher to be one of the valuable opportunities of the research project that of direct and personal contact with the interface of small business activity and management.

#### 5.10 Small Business Units in the Furniture and Timber Industry as a Survey Area

The Small Business Centre of Durham University had over a period developed knowledge of and a co-operative relationship with the Furniture and Timber Industry Training Board which provided both an opportunity for the researcher to tap their sources and an assurance about the unbiased nature of these sources. Would the furniture and timber industry in the North East however, provide an area of field work which met the criteria necessary to test the hypothesis? Enquiry revealed a scenario of medium and small companies or business units rather than large enterprises and which included timber importers based on East Coast ports. With the exception of companies who were predominately importers and therefore not concerned much with manufacturing, the industry seemed to have a reasonable consistency in its technology and type of production within the 100-499 size range. The low incidence of high volume production of single products, on the one hand, and of companies which made a wide variety of jobbing orders (jobbing joinery shops serving the building and construction industry are within the separate construction industry classification) meant that the dominant mode of production was batch production.

Within the companies listed as operationally separate clients by the F.T.I.T.B were a number of small business units which were in fact subsidiaries of other often quite large companies.

Although they were regarded as separate small business units by the Board this did not necessarily mean that they could be so regarded in this research. After discussion with the Board as to the nature of separation or independence of these small units it was decided that they would strengthen the data collected

provided that the management accounting resource and the work measurement resource or its alternative were located at the unit and there was a clear physical and decentralised organisational separation of the small unit from the parent company.

A common process of cutting linear or panel timber to size, machining or shaping, coating with veneer or plastic, assembly, together with some parallel upholstering activity in many instances, was perceived as a mainly consistent technology. Steel is used as a raw material for some furniture products but the operations are so similar to those for timber furniture that this was not regarded as an inconsistency.

To choose to carry out field work observation in the furniture and timber industry then seemed to overcome the problem of generating sample groups with technologies and types of production so different that the groups might not be considered comparable. It would also avoid the likelihood of bias that would arise from the selection process necessary to achieve comparability if using a sample from a variety of industries. Such a choice then would strengthen the whole research design and improve the validity of the results; but would these results be transferable to small business units in other industries?

On balance it was felt that the choice between validity and transferability should be weighted towards validity in that results which are more valid within a restricted field are seen as being more desirable than less reliable results from a more representative environment of small businesses. However, transferability is not necessarily sacrificed by working in one particular industrial

segment of the small business field. It can be argued that because of the relative consistency and type of such business an appraisal of the extent to which the results might be applicable to a given industrial segment can be made more effectively in that a more accurate comparison between the processes in a given industry and the processes in the furniture and timber industry can be made than when comparing processes in a given industry with a matrix of processes from several industries.

In view of these considerations the furniture and timber industry was chosen as the field area for investigation and the co-operation of the Furniture and Timber Industry Training Board was sought in establishing entry into this field work. A list was supplied by the Board of all companies registered with the F.T.I.T.B as having between 100 and 499 employees and located within the area supervised by the Northern Training Officer. This area was bounded by Berwick in the North and Whitby in the South and extended over to the Cumbrian coast.

Having discussed the desirability from a research design standpoint of generating two groups of small business units which are comparable (apart from the experimental variance) how is it proposed to measure whether like is being compared with like in those groups actually generated from the Furniture and Timber Industry? A construct - Small Business Profile is proposed to this end which draws on characteristics already referred to in this section such as mode of production and ratio of labour to material costs. This construct - Small Business Profile is set out as a measurable independent variable in the next chapter.

### 5.11 Interview Schedules

The survey strategy of generating two comparable groups of businesses from the Furniture and Timber Industry provided the opportunity for data collection by interview schedules conducted with all the companies from the more restricted population of all those companies from a single industry prepared to participate in the research. This would generate two groups who were common in their use of management accounting but dichotomous in their use/non use of work measurement as illustrated in Fig.1, and would discard respondents who failed to satisfy these parameters.

The anticipated homogeneous nature of the furniture and timber industry was expected to generate two samples where like was being compared with like in a business or industrial sense thus avoiding the bias that could have arisen by using judgement to filter out companies viewed as being non comparable.

Commenting on the use of interview schedules Oppenheim (11) indicates the sense of security the researcher feels due to the fact that the data were collected in face to face situations. This was an important consideration in this particular research design as in order to measure the profiles correctly, more than one person had to respond to questions and the use of a mail questionnaire would not necessarily have ensured this which would have had the associated consequences of lesser quantity and lesser quality of response.

The lower response rate associated with mail questionnaires might have applied particularly to small business units who were known to be faced with a general problem of availability of time and of

(11) A.N. Openheim Questionnaire design and attitude measurement Heinemann Educational Books Ltd. London 1966 Page 32.

motivation to deal with the numerous requests from various official units for extensive data. The arrival through the post of a multi-page questionnaire to be completed by different people would in all likelihood have been ignored by many owners or managing directors. Even if there was an initial intention to participate, this might have faded due to the reluctance of other individuals to complete their part of the questionnaire or again, the quality might have suffered by the managing director dealing with the whole questionnaire himself. Other disadvantages of mail questionnaires are that the questionnaire has to be made much simpler as no additional information explanation can be given, there is no control over the sequence of the questions and no opportunity to use cards to facilitate ranking of properties or features.

The intention to use an interview schedule and a given list of companies comprising the population of small firms engaged in the furniture and timber industry in the Northern Region would still require the use of an initial mail enquiry to find out which companies were prepared to participate. A carefully worded one page letter, however, followed by a telephone call was expected to be a more effective stimulus to create a response than a mailed questionnaire. When an initial positive response was achieved, the interviewer could then persevere with arranging interviews with the different individuals in each company. This opportunity to persevere is associated with what in the opinion of Oppenheim (12) is the greatest advantage of the interview - that is its flexibility. The interviewer can under many

(12) Ibid Page 31

circumstances adjust the timing of his interview to the convenience of the respondent with the anticipated effect of initiating and maintaining a rapport which will keep the respondent interested and responsive throughout the interview. He can also make sure that the respondent has understood the question and can probe further when particular responses are encountered. It also gives an opportunity for the variety and spontaneity of information associated with verbatim comment to emerge at appropriate stages in the interview.

Much generalisation of this nature is associated however, with the use of an experienced interviewer and therefore these advantages need to be discounted to a certain degree in this research given the limited experience of the researcher. The researcher would need to be mindful of the possibilities of bias and of other dangers in the interview method. The interviewer might unwittingly influence the respondent by a tone of voice or the way in which the questions were read out. Tone or emphasis may unconsciously communicate to the respondent an expectation by the interviewer of a certain view or attitude which the respondent then provides rather than his own true perception. Apart from the need to be convincing about confidentiality, the researcher would need to take care to appear in a non definable status role and to avoid any impression, to such respondents as supervisors, which was akin to that of an elevated or managerial status role. The approach of the interviewer would need to be so as to avoid systematic bias and yet at the same time, reap the harvest of information that only the interview schedule can give. He would whilst accepting the possibility of bias, have to take every care to lessen the occurrence of systematic bias.

The rejection of the use of a mail questionnaire to collect data about the variables in the research design in favour of personal interviews did open up consideration of an alternative means of data collection to that of a questionnaire schedule. Interviews might have been conducted on a loosely structured basis using some predetermined questions but with the bulk of the data coming from fluid open ended discussion which would be noted and then analysed later. Although this type of interview is viewed as being useful where research is exploring or mapping an area to arrive at classifications or to discover what variables exist it was seen to be less appropriate in this research where already identified variables needed to be measured using a measuring instrument which would give consistent and reliable measures with repeated application. Thus the questionnaire schedule with questions structured specifically in relation to each variable, but with some opportunity for free ranging open comment by the respondent, and applied with flexible programming to suit the respondent was confirmed as the means of data collection.

The questionnaire which was evolved for data collection and a note on its design and application are set out in Appendix A. The several variables to be measured by the questionnaire are developed or summarised in the next chapter with in each case, references to the particular questions relevant to that variable.

### 5.12 Summary

This chapter has clarified the nature of the research being undertaken as a combination of case study and correlational research. Testing, measurement, variance control, validity and reliability, were all considered as necessary features of the design of such research. These considerations, together with earlier theoretical analysis were used to formulate hypotheses linking positively the use of work measurement with the perceived usefulness of management accounting information by decision makers and accountants. A number of constructs and variables were then proposed and set in a suitable structural framework of independent, dependent and extraneous variables, for the testing of the hypotheses. A feature of this framework was the generation of two sample groups who were dichotomous in their "Use" or "Non use" of work measurement but whose business profile was similar in other respects such as the technology operated or the type of production used. The furniture and Timber Industry was selected as an industrial segment which offered this commonality of business profile and also opportunity for access for field investigation. Finally, the use of interview schedules was selected as the most appropriate means of data collection from the two sample groups.

CHAPTER VIRESEARCH CONSTRUCTS AND VARIABLES

6.00 Having examined aspects of research design and testing in Chapter V this chapter examines in turn each of the constructs and the variables they become, which formed the framework of testing as set out in Fig.2. Each construct is developed to one or more measurable variables which are then operationally defined and reference is made to the specific items in the questionnaire schedule in Appendix A which are used to measure these definitions.

6.1 The Use of Management Accounting Information

The first construct to be considered is the state of use of the management accounting information system, if any, in the small business units. As one of the main vectors of the hypotheses is the perceived usefulness of management accounting information, it implies that small businesses will have systems in operation that generate such information as a basis of decision making. Furthermore, it is anticipated that the part of this information which is concerned with budgeted direct labour activity has been derived from some classified method of assessment of labour activity. Not all businesses however, will necessarily have such a system and some standard state of use needs to be established as an independent experimental variable. It is experimental in that it is used as a manipulative tool to generate a sample of small businesses in which the hypotheses can be tested.

Drawing on Chapter II, Sections 2.1 to 2.4 and 2.9, the use of management accounting would involve the application of management accounting knowledge to the task of providing information in a

suitable form derived from all the relevant records of the business to assist in decision making. The detailed nature of information associated with assessment of direct labour activity, and the typical organisational control of that activity in a business, focuses attention towards small managerial decision making. Such decision making would lie with supervisors or managers and would involve such activities as planning, analysing alternative courses of action, or appraisal of performance.

The views of academic accountants and accountants working in small businesses were sought in relation to an appropriate level of accounting knowledge required in a small business in order to provide useful information to such decision makers. As a result this was operationally defined as the business having used for two years or more, an information system which showed anticipated, planned, or budgeted costs and which generated statements of actual costs in relation to those budgeted. The business would employ a full time person with two years or more of experience of cost control systems. Such a person would not necessarily have the title of accountant, he might be called the company secretary for instance, but his function should include responsibility for a management accounting information system. He would not be required to have any formal level of qualification as part of the operational definition and so question 2-10b provides additional interest data. This level of accounting knowledge and experience is measured in the interview schedule attached as Appendix A by questions 1-15, 1-17, 2-03, 2-04, 2-09, 1-12, 1-13, 1-14, 2-01, 2-02, 2-10a, addressed to the chief executive and the accountant.

The provision of information in a suitable form for decision making would require generation, at periods of one month or less, of operating statements which showed actual costs of labour against budgeted or anticipated costs. In accordance with the view expressed in Section 2.1 that relevant information is not limited to traditional accountancy records any quantified operating statements showing actual output of direct labour against budgeted output in terms of units or weight would fall within the operational definition. The information generated would be made available to decision makers in the manufacturing function of the business preferably at first line or supervisory level of management and at least at second line departmental level. This provision of information to decision makers is measured by the following questions from the schedule:- 1-15, 1-16, 1-18 (question 1-19 is intended as a cross check and probe in case of an initial nil response to the questions on budgeting) 2-03, 2-04, 2-05, 2-07 and 2-08.

Question 2-06 establishes the use of a management accounting information system in which information about anticipated labour activity is linked with a source involving a classifiable technique of assessment such as estimating or work measurement.

These measures of this independent experimental variable are intended to be applied to all small business units which respond to the invitation to participate in the field work part of the research. Small business units not falling within the operational definition of use of management accounting will not be included in the groups for investigation of the state of the dependent variable.

## 6.2 Use of Work Measurement - Non Use of Work Measurement

The construct - Use of Work Measurement and the construct - Non Use of Work Measurement, together form the main manipulative vector of the research design. This research is concerned with the likely effect on the perceived usefulness of information, by the use of the management technique of work measurement, hence the Use/ Non Use of Work Measurement are the variables which are altered experimentally by design of the research instrument and so become the independent experimental variables. There was, in earlier chapters, a detailed analysis of work measurement and management accounting in order to establish where the links of the properties of one with another were to be found. It is still necessary however, to draw out the profile of these independent variables so that they can be measured and manipulated in a way which avoids the effects of the variable being confused or cancelled by additional influences.

One way of designing research to avoid external variances building up to the extent that they influence the relationships postulated, but which themselves are not the objects of study, is randomisation or the selection and assignment of subjects by random means. Such a selection of companies to be the vehicles of the testing procedure would probably result in a sample of companies in which the use of work measurement ranged through a spectrum from intensive use of work measurement at one end, through partial use of the technique, to nil use at the other end. This gradation of use presents two difficulties, firstly, the design of some suitable measuring scale to represent faithfully the different degrees of usage - bearing in mind that there are several parameters to be taken into account on some weighting basis. Secondly, if instead of a scale of usage, the whole spectrum was divided into two groups, one half being classed

as users and the other half as non users, there would be some degree of difficulty in drawing a line through the spectrum, or of deciding on which side of the line a company should be placed.

Kerlinger (1) however, includes a research design feature to assist with such difficulties of variance control and that is the maximisation of the experimental variance. He suggests that development of a research design which enables any hypotheses to be tested with requisite care, is assisted by the concept of maximisation of the experimental variance. This involves maximising the systematic effects of the appropriate variables in the hypotheses by emphasising the differences in groups or phenomena.

Applying this concept to the work measurement variables leads to a rejection of the idea of a randomised group of companies in which various levels of work measurement effectiveness would be identified in favour of two groups of companies where the emphasised different condition between them, would be the USE or NON USE of work measurement.

By having an independent variable of this dichotomous nature, the resultant research design will enhance the means of testing for the existence or otherwise of a relationship between work measurement and management accounting information. It is suggested that such emphasis of differences in groups offers greater opportunity for achieving a higher degree of validity and reliability than the measurement of gradations of effectiveness of work measurement.

Although the development of these independent variables in a dichotomous manner is unique methodology, nevertheless the actual

(1) F. Kerlinger Foundations of Behavioural Research. Holt Rinehart 1973. Ch. 17

questions used to establish the operational profiles have, in general, already been used by other researchers and have also been retested for this research. This methodology therefore, is considered likely to produce valid and reliable measures.

#### 6.3.1 Use of Work Measurement - Independent Experimental Variable

From the review of research and investigations into the manifestation of work measurement in organisations carried out in Chapter IV, there emerges a profile or measure which enables a company to be classified in a generally acceptable sense as a "User" or work measurement. Such a measure forms the basis of a suitable operational definition of a work measurement "User" and a framework of reference for defining "Non Users" as dimensions of the independent variable in this research.

As far as particular work measurement techniques are concerned, a typical user would be found to be making use of one of, or a combination of, the following techniques for assessment of their direct labour activity: time study with its structure of element breakdown, rating and the application of allowances; activity sampling; predetermined motion time systems; standard data; and analytical estimating. There is no distinction in the earlier research surveys between the use of a technique for one purpose or another; for example between measuring individual direct labour activity and measuring group direct labour activity, or between measuring direct and indirect labour activity. The textual writings suggest for example, that activity sampling is in the main used to ascertain percentages of delay or phenomena such as crane or fork lift truck activity. However, it may be that a user company does, in fact, assess its main direct labour tasks by rated activity sampling. Again the type of rating scale used is not seen to affect the use state,

neither is the nature of any allowance system.

The degree of coverage of work measurement in terms of the proportion of direct labour activity assessed by work measurement in terms of the proportion of direct labour activity assessed by work measurement, which would qualify a company for inclusion into the use classification, would need to be a somewhat arbitrary level which could vary with the particular form of production and on which a judgement would be formed, following pilot studies.

Considering now the reviews of recruitment and training, then use of work measurement by a company would imply that practitioners in the main, have had at about four years of industrial experience prior to training in work measurement. Training in work measurement principles and techniques will have been conducted by colleges, or work study schools or consultants, and not simply by exposure to practitioner colleagues. Prior academic qualifications, certificates in work measurement, or professional membership of I.W.S.P. do not appear to be necessary attributes held by practitioners for their company to be classified as a user of work measurement.

The experience parameter of the classification profile would seem to emerge in the form that to be considered as a user of work measurement a company would need to have been using the technique for at least two years and to have been employing for its main thrust of work measurement a person(s) having not less than two years of experience as a work study practitioner. This form within the profile cannot be drawn very precisely and some judgement based on the particular situation might have to be made as to whether a given company would fall within the classification.

For example, a small company which has recently embarked on the introduction of work measurement by having one of its experienced staff trained by a nationally accepted course, could hardly be classed as a user of work measurement if the practitioner had been operating for only 9 months. If however, a company had used the technique of work measurement by employing an experienced practitioner for two years, a period which could be regarded as long enough to overcome implementation difficulties and that experienced practitioner had been replaced by a newly trained man, the company would not automatically be excluded from the user classification.

This operational profile of the Use of Work Measurement is measured by the use of the following questions in the interview schedule. The use of particular work measurement techniques and the extent of usage of work measurement is covered by questions 1-20, 1-22, 1-23, 3-01, 3-02. The training of the work study practitioner is measured by questions 3-06, 3-07, 1-21 and 3-03. Questions 1-24 and 1-25 are designed to contribute to an identification of a link between work measurement and the management accounting system in conjunction with question 2-06.

### 6.3.2 Use of Work Measurement - Moderator Variable

The indications of a typical usage state of work measurement having been established as one vector of the independent experimental variable, the construct Use of Work Measurement is now extended to take account of different levels of the state of use which might because of their existence, have a further systematic effect on the variance. An analysis of investigations suggest there are a number of criteria that represent different levels of the state and which call for measurement because of their possible

modifying effect in either a positive or negative direction on the dependent variable.

Faherty, Hall and Sparks (2) have suggested a means of assessing the quality of a work measurement department in a paper which they do not claim to be definitive, but submit as a base for development. They suggest a methodology of taking account of a number of weighted factors. Two sub-factors they give considerable weight to, are whether regular rating check sessions are held and whether levels of operator performance are reviewed at regular intervals.

Reuter (3) in his California and New York studies, found less than half the companies had carried out rating checks on their time study analysts using films within the last year, and that no more than 60% had used films in the last 3 years. Nearly 40% of firms in the California and New York studies admitted to never using rating films, but he still regards rating checks as helping to improve the quality of work measurement. As far as review of performance is concerned, Bevis (4) in his study of the effect of the learning curve on operator performance repetitive tasks, concluded that:

"There is a need for operatives work study personnel and management to agree to frequent method and time studies in repetitive tasks."

- (2) B.T.Faherty, C.B.Ball, D.A.Sparks. The Quality of Work Measurement Work Study and Management Sciences, June 1970 Pages 467-470
- (3) V.G.Reuter. Work Measurement Practices. California Management Review 1971 Part 14 Pages 24-30
- (4) F.W. Bevis. An Exploratory Study of Industrial Learning with Special Reference to Work Study Standards. Unpublished MSc Thesis U.W.I.S.T. March 1970

An aspect of the environment of work measurement which Reuter (5) comments on is the conduct of appreciation training programmes for foreman, managers and union officials aimed at securing the acceptance and co-operation necessary for effective work measurement. He reports high percentages (over 80%) of companies who run such programmes for foremen and supervisors and around 40% of companies who run such courses for union officers. Faherty (6) et al identify appreciation courses as a factor in the quality of work measurement but weight them much lower than training of practitioners or the use of appropriate techniques, whilst Bevis and Collier (7) report 64% of companies arranging courses for foremen and staff with a figure of 33% for shop stewards.

There is almost no reference in investigations to the need for detailed specification of methods when standards are issued, but both Minter (8) and Faherty (9) et al, imply that this has some importance. The lack of reference probably arises from the expectation that a detailed specification is implicit in the time study procedure of breaking tasks down into elements.

(5) Reuter op cit Pages 24-30

(6) Faherty Hall and Sparks op cit Pages 467-470

(7) F.W.Bevis & P.I.Collier. An Industrial Survey of Work Study in Wales 1963-65. An unpublished paper Welsh College of Advanced Technology.

(8) A.L. Minter. A Critical Analysis of Work Study. Unpublished Thesis MSc(Eng) University of London. June 1967 Pages 4-7

(9) Faherty Hall & Sparks op cit Pages 467-470

Although Faherty (10) et al do include systematic setting of allowances in their quality assessment factors and its contribution to information accuracy was suggested in section 3.8, the uncertain state of knowledge instanced in 3.8 by Dudley (11) and Karger and Bayha (12) together with the views of Murrell (13) suggest however, that any particular system of setting of allowances would not be a measure of higher level of work measurement usage.

When considering the organisational aspects of work measurement, investigators tend to emphasise the ratio of production employees or total employees to work study staff. From their 55 company respondents employing some 80,000 people in production or operating activities, Longhurst and Kerridge (14) concluded that after the initial requirement of 1 work study engineer, an additional one is required for every 200 employees. For those companies with work study personnel, Bevis and Collier (15) found a ratio of 1 work study practitioner to 260 total employees, whereas Minter (16) found an average density of 1 practitioner to 280 workers.

(10) Ibid

(11) N.A.Dudley. Work Measurement Some Research Studies. Macmillan 1968 Page 34

(12) D.W. Karger & F.H. Bayha. Engineered Work Measurement. Industrial Press New York 1966 Pages 522-523

(13) K.F.H.Murrell. Fatigue Measurement, Continued Learning and Rating Capability - Report of a Research Conference 1971 Department of Applied Psychology U.W.I.S.T. Cardiff

(14) B.J.Longhurst & R.G.P.Kerridge. The Application of Work Measurement in Industry. Work Study & Manpower Services March 1972 Pages 126-128

(15) Bevis and Collier op cit Page 12

(16) Minter op cit Page 3

Faherty et al (17) in their proposed evaluation criteria for work measurement, log the need for the department to occupy a central place in the organisation rather than being tied to a particular department. Bevis and Collier (18) found that over 70% of companies had work study departments responsible to Works Manager level or above or to Group Headquarters. The remainder were responsible to various people from Production Engineers to Accountants.

These observations lead to a view that the presence of rating checks, operator performance checks, work study appreciation courses represent a refinement or higher degree of sophistication of the work measurement system and as such could be considered as having a possible reinforcing or positive effect on the systematic variance within the use group. On the other hand, the absence of job descriptions or manuals of work tasks, the responsibility to lower levels in the organisational hierarchy, or a higher ratio than 300 employees to 1 practitioner, whilst not excluding a company from being classified in the use group, might result in some negative effect on the systematic variance.

This operational definition of the moderator variable part of the construct Use of Work Measurement, is measured by the following questions in the interview schedule. The control checks on personal skills and operator performance are covered by questions 4-01, 4-02, 4-03 and 4-04 with work study appreciation covered by 4-07. The measure of procedural records is by question 4-05 and the organisational state by question 4-06 coupled with 1-02.

(17) Faherty, Hall & Sparks op cit Pages 467-470

(18) Bevis and Collier op cit Page 13

The independent experimental variable measures Use of Work Measurement, as outlined in 6.3.1 will be applied to those small business units willing to participate in the research. Only those units falling within the operational definition of use of work measurement will be included in the USE group (see Fig. 1) for subsequent measurement of the dependent variable. The response to the moderator variable measures, Use or Work Measurement, will be used for later analysis of possible moderating influences on the dependent variable.

#### 6.4.1 Non Use of Work Measurement - Independent Experimental Variable

This construct refers to the state of practice where work measurement is not used in a small business unit. As the other half of the main manipulative vector of the research structure it is an independent experimental variable whose existence is postulated as having a systematic effect on the dependent variable.

In the Use of Work Measurement state, because of the need to establish use of certain specialised techniques and exposure to certain specialised training, the operational definition of the Use of Work Measurement independent variable required questions to be asked of the practitioner as well as the chief executive. In this case the operational definition can be measured simply by questioning the chief executives of small business units.

The zero use of work measurement and the alternative form of assessment used is ascertained by questions 1-26, or 1-27 and 1-28. The non use of a work study officer is checked and the type of staff used instead ascertained by question 1-29. Questions 1-27 or 1-28 also contribute, together with 2-06 to determine the existence

of a linkage between the assessment of direct labour activity and the preparation of management accounting statements.

#### 6.4.2 Non Use of Work Measurement - Moderator Variable

In emphasising the difference in the two experimental variables, classifying lines have been drawn which select companies at the opposite end of the spectrum of usage of work measurement. Nevertheless, the definition of Non Use might include business units with a state which contained certain characteristics which had some positive effect on the systematic variance of the dependent variable. Such characteristics would be the timed observations of operators by an ordinary watch or the use of machine feeds and speeds or other forms of time based data. Again although a company was found not to be using time study or P.M.T.S. previous training or experience in work measurement by the foreman or estimator might, as a moderator variable, account for a positive influence in the variance. Alternatively, if there were some instances where assessors were not fully conversant with the assessment methods used as alternatives to work measurement, or not familiar with the firms technology, then the systematic variance could be affected in a negative way. An example of this would be where an estimator had recently been recruited from another industry or where an operator had recently been promoted to the role of estimator.

This further None Use state in a business is operationally defined by the responses to questions 5-01, 5-03, 5-04, 5-05 which are intended to establish the extent to which the methodology included any work measurement components or influences which might have moderated the effect of the independent variable. Questions 5-06,

5-07 and 5-09 have a similar objective in relation to personal skills and experience whilst 5-02 was a further confirmation of the links with the management accounting system.

As indicated, companies will not be placed in the Non Use of Work Measurement Group simply because they fail to qualify for the Use of Work Measurement Group. It will be necessary for them to match the Non Use independent variable definition before being so classified. Although the main purpose of the moderator variable is for subsequent analysis of wider characteristics, it may be that these particular measures show an accumulation of characteristics in a business unit to a level that questions whether or not that unit should be included in the Non Use of Work Measurement Group.

#### 6.5 Small Business Profile

In Chapter V section 5.10, the choice of the furniture and timber industry as a particular industrial segment in which to carry out a survey was made as a means of generating sample groups which would be comparable with each other apart from the manipulation of the independent experimental variable. The choice was made on the likelihood that the products, technology, mode of production, and other business characteristics would not be too dissimilar from one group to another. This construct Small Business Profile is a measure of this comparability between the two groups which will be empirically generated by the experimental variables. It is an independent variable but is not experimental or manipulative and it is operationally defined by the following items.

The mode or type of production carried out in the business is a main feature of the Profile together with the products made and the markets served. These characteristics are entities in themselves which for example, could demonstrate that one group might be dominated by small batch production of up market high quality furniture whilst the other group might be dominated by higher volume producers of cheap flat furniture. In addition these characteristics - mode of production, products, and markets, when joined together, might give an indication of technological differences between the manufacturing activities of the two groups.

The labour to material cost ratio would be yet another indicator of business comparability between the two groups. Again the size range of businesses to be studied is wide enough to give rise to size differences between the groups and differences might also arise with regard to the relative independence of business units in the groups.

These indicators of the operational definition are measured by question 1-08 for products, 1-10 and 1-11 for mode of manufacture, and 1-01 and 1-09 for market environment. The labour to material cost ratio was measured by question 2-11, the size of the business unit together with its relationship with any parent or associated company, by questions 2-02, 1-03, 1-04, 1-05.

This data is not intended to influence the generation of the two groups but to indicate the presence and balance, in the empirically generated groups, of business characteristics separate and different from those of the experimental variable used in the generating process. The degree of balance of such characteristics would be a useful indication of the comparability of the two groups when the data is analysed and conclusions drawn.

## 6.6 Perceived Usefulness of Management Accounting Information

The independent experimental variables have been established as the manipulative vectors of the research design, first, Use of Management Accounting as an entry requirement into the experiment, then Use of Work Measurement and Non Use of Work Measurement, the two dichotomous states experimentally created to measure the difference in their respective influences on management accounting. The measure of the difference of the results of their influence is this construct Perceived Usefulness of Management Accounting Information, and as the other main vector of the hypothesised relationship it becomes the dependent variable. Outputs from the budget system such as profitability, and as measured by motivation, have been evaluated by Hofsteds (19) in his research. This current research does not aspire to such a broad measure of the output results of particular inputs into the management accounting system. Instead the more conservative but confident measurement aspiration of "perceived usefulness" is applied as a measure of assessing the output from the management accounting information system. The function of management accounting was elaborated in Chapter 11 and its role as an aid to decision making clarified. The level of decision makers with which this investigation is concerned and the availability of management accounting information to them was established in section 6.1. The further analysis of management accounting systems in Chapter 11 identified a number of properties whose presence is seen as rendering a management accounting system more beneficial or useful to decision makers. These properties

are grouped into classifications of accuracy, comparability and objectivity which may be observed as variables existing to some degree or other within information systems for decision makers. Taken as a whole, these properties as identified in Chapter 11 and as seen to be present to some degree or other by decision makers, form the construct Perceived Usefulness of Management Accounting Information. It is the change in the level of this perceived usefulness, which is postulated as being influenced by the variables Use or Non Use of Work Measurement and hence Perceived Usefulness of Management Accounting Information becomes the dependent variable.

The devising of measuring instruments for this key variable presented the researcher with an innovative task in that there was little if any evidence of previous work involving measurement of this construct. Furthermore, as the variable is one of the key pivots of the research design, the output of the research is heavily dependent on the effectiveness of these measures. The classification of those properties of usefulness which link with work measurement, viz accuracy, comparability and objectivity, is firmly based on the work of the various contributors to the American Accounting Association Report (20) referred to in section 2.4, but the degree of innovation arises in the operational measures of these properties.

The measures which follow were devised by transposing and adapting practices previously used to measure properties similar to those forming this construct. For example, the extent of a feeling or

(20) Report of the Committee on Concepts and Standards of Internal Planning and Control. American Accounting Association. The Accounting Review, October 1974.

opinion about an attitude, such as the knowledge possessed by a supervisor's peers, was measured by Hopwood (20.1) using a scale involving such verbalised divisions as "very little", "some", "considerable" and "very great". Again, in measuring one quality of an information system, that of understandability, Hoefstede (20.2) uses the verbalised divisions of "always", "mostly", "sometimes", "seldom" or "never". This form of measuring instrument is used in this research with all three properties of usefulness and the advice of an experienced researcher was taken up in that a 10 point scale of measurement is used to enable the respondent to clarify his choice of say "often" as being either closer to "very often" or closer to "sometimes."

The measure of the property objectivity, uses phrases thought to be meaningful to supervisors and managers such as "impartiality" and "bias", whilst comparability is approached on a basis of asking the respondent how reliable he thinks the accounting information is in comparing one job with another or one week or month with another. Accuracy, however, is a more complex property, and the general usage analogy of rifle shots on a target, as explained in section 2.6, is used to identify the constituent parts - reliability and precision. Another parallel is with the characteristics of the sample measurers of a batch of engineering components which arise in quality control such as:- range; average; and, position of average in relation to required value. These various characteristics had to be transposed into such meaningful phrases as "under estimate", "over estimate" and variation in the extent of over estimation from one job to another.

(20.1) Hopwood op cit Pages 213-215

(20.2) Hoefsted op cit Page 331

Whilst the measuring instruments devised cannot claim the same degree of confidence in their effectiveness as those used repeatedly by researchers, they were subject to a process of pre-testing with both accountants and supervisors and under field conditions. It can however be said that the way in which they were evolved and their testing builds up to a fair degree of overall effectiveness in the measures.

The operational state of this variable Perceived Usefulness of Management Accounting Information is measured by responses to the various questions as developed below. The same set of questions is applied to decision makers in both the USE and NON USE groups. Question 6-01 is the first of the introductory questions in that it provides a check on the production organisation of the company and will help the researcher to ensure that all first and second line management who are in receipt of management accounting information are interviewed. Question 6-02 is intended to orientate the respondent towards consideration of information generated and published by centralised departments and prepares the way for question 6-03. Questions 6-03 and 6-04 are a check on information already supplied and act as a basis for questions about usefulness of accounting information.

Operational measures and methods of coding are now developed for each of the properties and elements of the variable Perceived Usefulness of Management Accounting Information. Table 2 at the end of the section summarises the means of measurement and the methods of coding or scoring to be used in each case.

### 6.6.1 Accuracy

The first property of usefulness to be measured is that of accuracy. The concept of precision and reliability as components of accuracy were referred to and illustrated by analogy with rifle shots in section 2.6 page 30, reliability being the extent to which the shots were evenly scattered around the bulls eye and precision being close clustering of shots around a mean position anywhere on the target. One measure of the reliability component of management accounting information planned for this study is the difference in the proportion of assessments of direct labour activity regarded as being over estimated or under estimated in relation to the actual direct labour activity required in practice.

In response to questions 6-05 and 6-06 each decision maker would indicate what percentage of jobs or operations he thought were over or under estimated. If 100% of the assessments were thought to be over estimated this would be extremely low reliability as all of these assessments would have in terms of the rifle analogy missed the bulls eye of the target. The same condition would apply if a decision maker perceived 100% of the assessments to be underestimated. If a decision maker reported 90% over estimated and 10% under estimated, then the difference between these viz 80%, would be a further indication of low reliability.

On the other hand, if 50% of assessments were thought to be over estimated and 50% under estimated, this even balancing or zero difference of the assessments above and below the in practice values would be an indication of high reliability. A further example of higher reliability would be 40% of assessments reported as under

estimated, 50% as over estimated with 10% reported as accurate. This is a difference or imbalance of only 10% of assessments, the remaining 80% being balanced above and below or coincident with the direct labour activity values required in practice.

The need to take into account questionnaire design, and in particular the systematic ordering of questions for the benefit of the interviewee requires the deferment of measures of a second component of reliability in favour of measures of that part of accuracy known as precision. In terms of rifle shots on a target - are the rifle shots closely grouped or widely scattered irrespective of whether they straddle the bulls eye or lie above or below it.

In accounting information about direct labour activity, precision is the extent to which the assessments are perceived to vary from job to job in relation to the in practice value of these jobs - the extent to which the scatter of assessments of direct labour activity is perceived to be closely clustered or alternatively widely dispersed on either side of its mean. Irrespective of whether the spread of assessments was thought to lie below, above, or across the in practice values these might have a wide variation or range or they might be clustered in a narrow range.

Having established by means of questions 6-05 and 6-06 where each decision maker thought the spread of assessments was located, he would then be asked by means of questions 6-07 or 6-08 or 6-09 how wide he thought the variations were in assessments from job to job. The five categories of variation are divided into a ten point scale in order to generate a score of the width or span of the

variations perceived by each decision maker. In this case the lower scores would indicate a narrower variation or higher level of precision than the higher scores.

It is now possible, having measured the precision element or extent of the variations in assessments, to return to the other indicator or reliability and that is the closeness or proximity of the average of these variations of assessments of direct labour activity to their in practice values. In terms of the rifle shots analogy, irrespective of how closely grouped or widely scattered the shots are or whether the grouping is high or low the next consideration is how close is the centre of the group of shots to the bulls eye. How is this closeness or proximity to the in practice value to be measured?

Given that decision makers will have been asked questions about how wide or narrow were the variations in assessments from job to job, they would then be asked how close they thought the average of these variations was to the in practice values. A measuring scale of five classes of closeness or proximity has been constructed and as question 6-11 subdivided in order to generate a proximity score with a range of 1 to 10 for each decision maker. Higher scores would indicate closer proximity of the average value of the assessments to the in practice values than lower scores and hence a higher level of this component of reliability.

### 6.6.2 Comparability

The second property of usefulness to be measured is that of comparability. The concept of comparability was explored in section 2.7 which emphasised matching like with like in terms of entities such as cost centres or jobs or in terms of time periods, and such entities now form the indicators of comparability. The measures devised, using these indicators, of judging the extent to which information in the accounting statements is perceived to possess the property of comparability are manifest in questions 6-12 and 6-13. Ten point scales have been constructed which invite the decision maker to register how reliable a guide he finds assessed figures of direct labour activity to be, when comparing one job with another or one time period with another. The responses will be coded to yield comparability indices for both time and jobs with higher scores indicating higher levels of the property of comparability in the accounting information.

### 6.6.3 Objectivity

The third property of usefulness to be measured is that of objectivity which was explored as a concept in section 2.8. Objectivity is concerned with the degree of impartiality or bias in the source of accounting information. The perception by decision makers of bias in the means of assessing direct labour activity, which in this case is the data source, is measured by questions 6-14 and 6-15. A scale has been devised which gives decision makers the opportunity to register the source as being completely impartial or to register increasing degrees of bias in the source. The responses will be coded so that higher levels of bias earn low scores and lower levels of bias earn higher

scores with complete impartiality carrying the maximum score of 11. The decision maker is also invited to indicate the direction of any bias in the source of data. The direction of bias could of course be unfavourable towards the production department making targets difficult to achieve or favourable towards the production department, resulting in easier targets.

TABLE 2

The Measurement And Coding Of Properties Of Perceived Usefulness Of  
Management Accounting Information

PROPERTY OR ELEMENT	HOW MEASURED	METHOD OF CODING OR SCORING
<u>ACCURACY</u>		
Reliability	Differences in percentages of OVER/UNDER assessments (Q. 6-05 6-06)	Higher differences in percentages indicate lower reliability
Reliability	Proximity of average variations to in practice value (Q. 6-11)	Higher proximity scores on 1 to 10 scale indicate higher reliability
Precision	Range of variations about their mean (Q. 6-07 to 6-09)	Lower variation scores on 1 to 10 scale indicate higher precision
Precision	Open question on reasons for variations (Q. 6-10)	Comments reported verbatim
<u>COMPARABILITY</u>		
Job	Reliability of assessments as a guide in comparison of jobs (Q. 6-12)	Higher job comparability scores indicate more useful information
Time	Reliability of assessments as a guide in comparison of time periods (Q. 6-13)	Higher time comparability scores on 1 to 10 scale indicate more useful information
<u>OBJECTIVITY</u>		
	Impartiality or bias of method of assessment (Q. 6-14)	Higher scores on 1 to 11 scale indicate greater objectivity with 11 = completely impartial
	Direction of any bias (Q. 6-15)	Favourable/Unfavourable to production department
<u>USEFULNESS</u>		
	Open question on overall usefulness and different means of assessment (Q. 6-16 6-17)	Comments reported verbatim

## 6.7 Management Accounting System and Environment

In section 5.4 that part of Chapter V concerned with variance control, reference was made to controlling the extraneous variance. This is the effect of other systematic but unwanted variables which may influence the relationships postulated but which are not, themselves, the manipulated objects of study. The way in which controlling such variance in this research is attempted is to adopt the suggestion (see section 5.4) of building in extraneous variables into the design in order to measure them and assess their possible influence on one or other of the two groups of business units (see Fig.1). Influence might be of a confounding nature where positive results could arise from these unwanted variables reinforcing the influence of the experimental variables and of a cancelling nature where negative results could arise from these unwanted variables counteracting the effects of the designed variable.

The extraneous or unwanted variables in this research have a commonality which allows the formulation of a construct - Management Accounting Systems and Environment. This commonality arises from the variables forming a subsystem of processing and presenting information via a climatic environment. This subsystem and the climate in which it operates is seen to have component variables of:- Management Accounting Functions; Budget Standards; Participation; Superior Subordinate Relationships; and, Raw Materials Information.

Using relevant literature these component areas are each explored in this section and developed through into variables having operational definitions and means of measurement. The problem

of innovation did not arise in the devising of measures for this construct as the measuring instruments used for the variables had, in the main already been tested and used by such researchers as Hofstede (21), Hopwood (24), Hilal (23). Table 3 at the end of section 6.7.4 summarises the means of measurement and methods of coding or scoring to be used in each case.

#### 6.7.1 Management Accounting Function

The various properties of management accounting systems, as identified by the authors of the AAA Committee (24) together with such writers as Mattessich (25) and Gordon & Shillinglaw (26), have been used as a source to establish the dependent variable in this research and these properties are now used as a basis for identifying further factors which might influence this dependent variable.

Of the four separate activities which are regarded as constituting an internal accounting information system, measurement, with its comprehensive subdivision of properties has formed the basis of the dependent variable. The other three activities, problem specification, transmission and response are composed of properties

- (21) Hofstede op cit
- (22) A.G. Hopwood. An Accounting System and Managerial Behaviour Saxon House Lexington 1973
- (23) Hilal The Factors Affecting Cost Control by Shop Floor Management in the British Iron and Steel Industry. Unpublished PhD thesis Manchester University 1967
- (24) Report of the Committee on Concepts and Standards of Internal Planning and Control. American Accounting Association. The Accounting Review, October 1974
- (25) Richard Mattessich "Methodological Preconditions & Problems of a General Theory of Accounting" The Accounting Review July 1972
- (26) Myron J. Gordon, Gordon Shillinglaw Accounting A Management Approach. Richard D. Irwin Inc. Howewood Ill 3rd Edit. 1964

whose presence or absence might be regarded as having a cross or extraneous influence on the measurement activity whose components become, in this research, the construct usefulness of management accounting information.

Problem specification is viewed as partly the decision makers perception of his desire for information to meet his structuring of the decision and partly the accountants perception of these information requirements. Relevance is identified as being the property most directly related to problem specification and is defined as the property of information which enables a user to improve the results he achieves by utilising the information, and is evidenced by the closeness of information to variables associated with whatever objective function is being pursued. Thus perceptions of usefulness of management accounting systems could be influenced by relevance, which in turn is associated closely with the internal technique of aggregation.

Aggregation, the process of reducing the volume of data, carries with it a loss of information which may reduce the relevance of the information to the individual decision maker in his concern with the identification of certain events or groups of events and their associated variables. The need to aggregate data or to reduce it to a less aggregated form may affect another system's activity, that of transmission. Its effect on the main property of transmission would be, as identified by the authors of the AAA report (27) via timeliness. They report the Gregory and Horne (28) view that

(27) AAA Committee Report op cit Page 92

(28) Robert K.Gregory, Richard L.Van Horne Automatic Data - Processing Systems Principles and Procedures San Francisco, Calif Wadsworth Publishing Coy.In. 1960 Page 349

timeliness, or the age of information, has two components, interval and delay. The period of time - week or month, covered in statements of information being the interval, and the length of time after the close of the interval before the information is available for use, being the delay. The delay covers the time required to complete the collection of data, its processing into presentable form and its distribution to users. Timeliness then, is regarded as a desirable criterion of an internal accounting system and as such, its absence might have an influence on the perceived usefulness of the system by decision makers.

The fourth activity of information systems, the "response" aspect, is concerned with the recipient or decoder's perception of the information and the organizational environment in which he operates rather than the reality of the data base itself. Understandability is one property of this activity and according to the authors of the AAA (29) report:

"relates to the ability of the user of the system to ascertain the information being transmitted by the information system".

It is concerned with the ability of the recipient first of all to recognise or locate the presence of desired data, and then secondly, to decode the message. Thus in reality, the message may be present in the data and the recipient may be capable of interpreting it, but unless its location is clear to the recipient, he cannot achieve understandability.

The other relevant property of "response" which they highlight is motivation. In the context of the list of properties that should be present in accounting information systems, motivation refers to the

attempt to achieve goal congruence between the goal of the respondent and organisation goals. Congruence is achieved by motivating the respondent to change in the desired direction. It is stated as not only being related to the data base, but is a feature of the whole organisational environment. Thus, motivation is not only the effect of several properties of the information system, but derives from the environmental conditions surrounding the information system, such as the degree of participation in target setting and the style and nature of the superior's use of the budget as part of his relationship with his subordinate.

If the required properties of clarity and understandability are not present in an accounting information system, and the environmental conditions around the system are demotivating, then any positive effect of the presence of the independent variable, work measurement, on the perceived usefulness of the information system, may be cancelled out by such extraneous variables.

Sources other than the AAA (30) committee report are now explored by way of corroboration, and to consider additional factors such as participation, which might have to be taken into account in identifying extraneous variables.

According to Hilal (31) whereas most cost control research in the U.K. and U.S.A. had been concerned with information requirements of top management, his own work is specifically concerned with the relationship of control decisions to cost information at the level

(30) Ibid

(31) Hilal. The Factors Affecting Cost Control by Shop Floor Management in the British Iron and Steel Industry. Unpublished PhD thesis Manchester University 1967 Pages 4 & 5

of shop floor management. Unlike many other studies on cost control which concerned themselves with the accountant's concept of what makes cost control effective, Hilals (32) extensive investigation within the British Iron and Steel Industry was mainly concerned with the views of departmental managers and their subordinates, and how these contrast with the views of accountants. Concerning relevance, he found that cost reports which do not embody enough detailed analysis of information which is relevant to the recipient's interest, are less useful as a cost control tool than those reports which analysed relevant areas. A considerable proportion of managers and foremen interviewed commented that the lack of sufficient relevant details was a feature which adversely effected the usefulness of cost reports as a control decision tool.

In examining the behavioural nature of accounting, T.A. Lee (33) points out that the informational needs of an accounting nature are likely to vary from person to person. In order to influence behaviour, the accounting information must be appropriate to the user's particular information need. An individual will only perceive information as being useful to him if he regards it as being relevant to his personal needs and values. He points out that there is a body of argument from several writers to the effect that:

"the only useful information is relevant information - that is, the information which bears upon the decision and actions of the user"

(32) Ibid Page 5

(33) T.A. Lee "Psychological Aspects of Accounting" in Accounting and Business Research. Summer 1975 Pages 231, 232

The timeliness of cost reports is, according to Hilal (34) also a significant feature of cost reports which can have an important impact on their use as a cost control tool, and that delay in presenting cost information impairs effective decision making. He reports that the views of managers and foremen operating within a decentralised system of management accounting information service, were in support of the improved timeliness of the cost information they received from their departmental accountants, who, being less remote than in a centralised system, were able to provide information relatively quickly.

Hofstede (35) found timeliness to be perceived as being important by two different sources; on the one hand, accountants were concerned about making sure that information was available in time, and on the other, line managers in the main, made sure that they received the really crucial decision making information for when they needed it. He does point out however, that information which indicates the level of performance, as distinct from that which indicates problems to be solved, need not be immediately available. He concludes that timeliness belongs to the "hygienic" part of the motivational spectrum, implying adverse reaction against the information if the communication is late but that timely information does not necessarily provide a stimulus to particular behaviour necessary for decision making.

Understandability is also classed by Hofstede (36) as a hygiene factor, the presence of which in accounting information is regarded

(34) Hilal op cit Page 487

(35) G.H. Hofstede The Game of Budget Control. Tavistock Ltd.  
London 1968 Pages 199-214

(36) Ibid

as essential by managers and supervisors. He suggests that lack of understandability can arise from the accountant not realising how different the language of his feedback information appears to the recipient manager. The effectiveness of supervisors as decision makers was found by Hilal (37) to be affected by the extent to which they understood cost information. Insufficient use of words and of physical values, coupled with a dominance of monetary information was seen to lead to adverse opinions by managers and supervisors about the usefulness of costing information.

Associated with understandability is the factor of personal or direct communications between accounting staff and line management. An early experimental study of budgeting by Simon (38) et al aimed mainly at investigating, on a qualitative rather than quantitative basis, the consequences of decentralisation within the accounting organisation, included a relevant conclusion in this area. This was to the effect that an essential component of the effectiveness of the information services provided by the accountancy department is to have direct and active person to person communication with line management.

Hofstede (39) also examines the importance of interpersonal communication for periodic accounting reports and arrives at the same result as Simon et al (40). He finds that the effect on line

(37) Hilal op cit Pages 490, 499, 500

(38) H.A. Simon, H. Guetzkow, G. Kolmetsky & G. Tyndall  
Centralisation and Decentralisation in Organising the  
Controllers Dept. New York Controllershship Foundation Inc.1954

(39) Hofstede op cit Pages 199-203

(40) Simon op cit

management of periodic management information such as budget variance reports, appears to depend on it being accompanied by personal two way communication between the accounting staff and line management and more so, between the recipient of the reports and his own boss. He stresses the importance of developing an atmosphere of co-operation within this staff line communication subsystem and that this is largely dependent on the staffs' interpretation of their role.

Hilals (41) view of this interpersonal communication between accounting staff and line management, is that it is the vehicle by which the accountant can accomplish a necessary educational role in order to improve understanding of accounting information by decision makers. He found this was best achieved by an informal approach in which the nature ( in terms of tact and a spirit of co-operation), and frequency of contact between the two groups were essential.

Relevance, timeliness and understandability, although classified by the AAA Committee Report (42) as properties under separate activity areas, do emanate from one system source. They can be considered as a set of properties which has as its common factors, origins in, and influence by, the management account function itself rather than from the original data source and its method of measurement, or from the climate of the environment in which the function exists. They result from the attitudes and consequent

(41) Hilal op cit Pages 396, 425, 499

(42) AAA Committee Report op cit Page 82

decisions of accountants and from the organisational structure of the management accounting system.

This Management Accounting Function component of the construct Management Accounting Systems and Environment then as a possible extraneous influence, is operationally defined by the presence of the properties of relevance, timeliness and understandability.

The decision maker will be asked about the frequency of receipt of accounting information in Question 7-16 (Appendix A) and the extent to which he finds these reports timely for his purpose by Questions 7-18. This consists of a ten point scale enquiring how often were reports received timely enough for the decision makers purpose. The range of the scale was from perceptions of reports being timely "very rarely" through to "very often" for the decision maker's purpose. The decision maker will be asked in Questions 7-17 about the extent to which he finds the reports relevant to his activity and will have the opportunity to respond on a ten point scale ranging from "very rarely relevant" to "very often relevant". Understandability will be measured by the responses to the ten point scales of:

- a) frequency about discussions with accountants
- b) the extent to which reports are perceived to be clear and understandable

and

- c) the degree of co-operation thought to exist between the accountancy section and the production department.

(Questions 7-20, 7-19 and 7-21)

### 6.7.2 Organisational Environment of Management Accounting

It is now appropriate to search for further properties or features associated with a wider organisational environment in which the accounting system is found which might summate to an extraneous influence. Earlier reference has been made to the concept that motivation to goal congruence was related not only to the effect of several properties of the information system as grouped above, but that it also derives from the environmental conditions in which the management accounting system operates. In extending this analysis over to a consideration of those properties which are a feature of the whole organisational environment of the management accounting system and which might have an extraneous influence on the perceived usefulness of the system, it is appropriate to refer to an early classic behavioural study of budgeting carried out by Argyris (43) in 1952. In summarising his work which was exploratory without prior hypotheses, Argyris concludes that pressure by higher management and fault finding by accountancy staff gives rise to tension, feelings of failure and other human relations problems, with the budget itself a neutral thing often becoming the object of blame and aggression, aggression also being directed at the accountancy department. He recommends that management behaviour to avoid these consequences should be directed to genuine, not pseudo participation in standard setting and that accountancy staff should, by training in human relations, come to a better understanding of the human implications of the budget system and of how to get along better with factory people.

(43) Chris Argyris. Human Problems with Budgets. Harvard Business Review 1953 Pages 97-110

Hofstede (44) suggests that the emphasis of this work on the human side of the problem was so great that it overcompensated for the traditional budgeting theory and showed only the negative motivational aspects of budgeting. He concurs however, with the Buckley and McKenna (45) view that the study has an enduring influence and relevance, particularly where cost accounting systems are still based on authoritative models of behaviour.

The organisational environment of accounting systems was a feature of Hofstede's (46) extensive research carried out in several manufacturing plants across different industries in the Netherlands. He used concepts from accounting, organisational, and psychological theories, and structured his investigation into budgetary control within the systems concept of inputs and outputs. The outputs of the budget system in his research design, were construed as being the contribution of the system to organisational goals as measured by the motivation of managers to better performance and by their job satisfaction. His predicted inputs to the system comprised the policy of setting budget standards, the degree of participation in setting these standards, the behaviour of the superior line manager to the recipient of information, and the technical and personal contribution of the staff departments of work study and management accounting.

(44) Hofstede op cit Pages 41/42

(45) Adrian Buckley & Eugene McKenna Budgetary Control and Business Behaviour Accounting and Business Research. Spring 1972 Pages 137-150

(46) Hofstede op cit

### 6.7.3 Budget Standards

The first variable associated with the Organisational Environment of Management Accounting is that of Budget Standards. As far as the overall organisational policy of setting standards tightly or loosely is concerned, Hofsted's conclusions (47) are that budgets which are too loose have a low score on his "relevance" measure of motivation, that is they cease to be regarded as important or useful and less attention is paid to them. On the other hand, budgets which are too tight have a low "attitude" measure characterised also by a rejection of the budget in that managers or supervisors preferred their superiors not to use standards at all. Hilal (48) also came to the conclusion that where standards are set at an unattainable level, managers and supervisors reject them and the budget, as being unrealistic.

Buckley and McKenna (49) in considering motivational aspects of budgetary control, take the view that Hofstede's (50) research; results in the identification of relationship between the spectrum of tight through to loose standards aspiration levels and rejection or acceptance of budgets; and confirms much of the earlier work of Stedry and Kay (51) and that of Child and Whiting (52). The latter found that if difficult goals are set and there is subsequent

(47) Ibid Pages 127-129, 144, 160

(48) Hilal op cit Page 498

(49) Adrian Buckley & Eugene McKenna op cit Page 144

(50) Hofstede op cit Page 144

(51) A.C. Stedry & E. Kay as quoted in Adrian Buckley & Eugene McKenna op cit Page 144

(52) I.L. Child & J.W.M. Whiting as quoted Ibid Pages 144--45

failure to achieve these, then the budget standard is perceived as being impossible and withdrawal symptoms develop. On the other hand, achievement of difficult goals seemed to result in the formal goal or standard becoming an aspiration level. Miles and Vergin (53) indicate that although there is much criticism from behavioural scientists about control systems, there is less prescription from them about desirable conditions which would avoid human behaviour problems. Nevertheless they feel that some generalised abstractions are possible. For example, control systems which have less tendency to exhibit such symptoms of behaviour problems as aggression, tension and withdrawal would have standards recognised as being fair and achievable and arrived at through participation. They would not be used by superiors for unfair censure of performance and performance data would be fed back readily and directly to those involved in the activity.

The foregoing suggests that if budget standards were perceived to be either too loose or too tight by decision makers in one of the groups of furniture or timber companies, then this might lead them to regard the budget on the one hand as not being important or useful or on the other rejecting it as being unrealistic. Either of these states would be a possible influence on the decision maker's perception of management accounting information which was extraneous to the designed experimental variable. Such policy of setting standards or targets for direct labour policy, as a variable, is measured by questions 7-06 and 7-07.

(53) R.E. Miles & R.C. Vergin as quoted Ibid Page 144

#### 6.7.4 Participation

The next component of the construct Management Accounting and Environment, is participation in the setting of standards in the budget or control statement.

The degree of participation in the setting of standards by the budgetee, as an input to the budget system, was examined by Hofstede (54) and conclusions drawn about its effect on motivation. In testing his hypothesis that higher participation leads to higher motivation to fulfil the standards, he found a difference in budgetees reactions to participation in financial and non-financial budget setting. Of all the quantified aspects of the budget system studied, participation in financial standard setting is the one with the strongest effect on motivation to fulfil standards. Participation in non financial standards was found to be considered as a prerogative of almost all managers and they felt dissatisfied if they were not involved enough.

Hilal (55) concluded that the extent of participation in the setting of standards was found to have an influence on the full acceptance of these standards by shop floor management. Where there was full participation in standard setting, there was greater inclination to accept standards as fair and realistic than in those cases where participation was limited or non existent. This correlation appears to be also based on differences in participation between heirarchical levels as the majority of departmental managers interviewed were participating in the process of setting their

(54) Hofstede op cit Pages 173-198

(55) Hilal op cit Pages 498, 255, 370, 373, 387

departmental cost and performance standards whereas foremen in the main were not allowed to participate in standard setting. The need for participation is particularly evident as a felt need if the standard is being used to measure personal efficiency. The views of accountants and secretaries were monitored and they pointed out the need for shop floor management to participate in setting standards in order to gain acceptability of standards and targets by those who were expected to work to them.

T.A. Lee (56) in presenting a representative selection of views and findings about the behaviour implications of budgets, refers to Wallace's (57) recommendation of participation by managers and employees in the budget process in order to raise morale and increase initiative and also to the Becker and Green (58) philosophy that realistic participation in budgets increased employee morale and thereby increased productivity.

Although Lee (59) quoted Stedry's (60) criticism of these views on the grounds of lack of specific evidence to support the participation - morale - productivity relationship, he ignores the later work of

(56) Lee op cit Pages 232, 233

(57) Michael E. Wallace "Behavioural Considerations in Budgeting" Management Accounting (U.S.A.) August 1966 Pages 3-8 as quoted in Lee op cit Page 232-233

(58) Selwyn W. Becker & David Green Jnr. "Budgeting and Employee Behaviour" The Journal of Business October 1962 Pages 392-402 as quoted in Lee op cit Pages 232-233

(59) Lee Ibid

(60) Andrew Stedry "Budgeting & Employee Behaviour" A Reply - The Journal of Business April 1964 Pages 195-202 as quoted in Lee op cit Page 233

Hofstede (61) which demonstrates a positive link between the extent of participation and the motivation of managers to better performance.

Although the role of participation in the budgetary process was not a major topic for investigation in Hopwood's (62) extensive study of the large industrial manufacturing division of a Chicago based company, he nevertheless gave systematic consideration to examining the belief that participation could help to moderate the effects that some particular styles of budget usage might have.

In his discussion on participation, Hopwood (63) warns against seeing participation in organisational decision making as a panacea and as a means of increasing morale and satisfaction. He maintains that much management accounting and budget literature remains entrenched in its unconditional view of the mystical healing capacities of participation. It remains infrequently analysed and those who advocate its use by accountants are influenced by the all too appealing generalisations of the human relations school. He takes a view that critical analysis and empirical investigation of the type carried out by Stedry, Hofstede and Becker and Green exceptions in that they do question its universal appeal and do examine conditions and factors which are likely to influence its impact and consequences.

(61) Hofstede op cit Pages 173-198

(62) Anthony G. Hopwood An Accounting System and Managerial Behaviour. Saxon House/Lexington 1973

(63) Ibid Pages 137-147

In his own research Hopwood (64) first derives conclusions about the relationship between different styles of using the budget for performance evaluation and the degree of financial tension on the one hand as expressed in the extent to which managers or supervisors worried about costs and budgets, and the degree of job related tension on the other as manifest in overall feelings of anxiety and frustration pervading the job. Financial tension is found to be high in both the Budget Constrained style i.e. that style which emphasises a rigid and narrow requirement of meeting immediate budget figures and in the Profit Conscious style i.e. that style more concerned with the longer term and more widespread effect of costs. Job related tension however, is found to be significantly lower in the Profit Conscious style.

He then further concludes that where participation of managers and supervisors existed, a significant degree of financial tension and awareness remained but that with both the Budget Constrained and Profit Conscious styles, there is a moderating influence on the job tension effect in that such budgettees are less likely to experience overall job related tension i.e. feelings of anxiety and frustration.

This examination of participation in the setting of standards leads to the conclusion that such participation is a state which may have extraneous influences on a decision maker's perception of information as far as this research is concerned. An index of participation comprising the total scores on Questions 7-02 to 7-05, taking into account frequency and weighting of the respondents contribution

and the influence of others was designed as the means of operationally measuring participation.

#### 6.7.5 Superior Subordinate Relationships

This examination of the environmental and organisational conditions in which the management accounting system operates has so far revealed the policy of setting budget standards and the degree of participation in setting budget standards as properties of the construct Management Accounting Systems and Environment which might have an extraneous effect on the perceived usefulness of management accounting information. Attention is now directed towards another feature of this environment, that of the relationship between superior and subordinate with particular reference to the way in which this relationship is manifest in the budget or management accounting information area.

Argyris (65) identifies leadership patterns as a particular problem area in the use of budget accounting techniques in that leadership patterns used in the daily industrial life of factory executives conditions their interest in budgets. Arising from the use of budgets as a means of expressing leadership and personality characteristics, the research found there were differences in the ways in which managers used budgets which though not classified, ranged from needling pressure by selective use of adverse information through to simply providing the information for self interpretation and action by the subordinate. His conclusion in relation to the use of budgets by superiors is that if used as "needlers" by executives, subordinates tend to take an adversely narrow view

of problems and that when manifestations of leadership style through the use of budgets result in people getting hurt "then the budget, itself a neutral thing, often gets blamed".

The leadership factor as manifest in superior subordinate relationship was found by Hofstede (66) to be a crucial one in its effects on the motivation output and the job satisfaction output of the budget system. Frequency of communication about cost variances with the boss and frequency and usefulness of group meetings of the boss with his subordinates were prominent in the inputs which showed the strongest overall correlation with budget motivation. The leadership influence of the boss through these inputs in which he is directly involved, affects both the 'relevance' and 'attitude' part of budget motivation, it extends from the hygienic side through to the positive motivation part of the spectrum. In assessing the frequency of the personal contact between superior and subordinate about budget figures and the pressure element in this contact, Hofstede (67) measured how often a subordinate thought his boss mentioned budget variances or efficiency variances in their day to day contact. The power or pressure element of budgets in the superior subordinate communication which he sees as being expressed most clearly in the act of performance appraisal of subordinates was measured by ranking several different performance criteria including budget variance in the order in which the subordinate thought he was being ranked by his superior. The analysis of these measures lead to the conclusion that the consequences of over emphasising results in appraisal, may involve an avoidance of risk, scapegoating and the faking of figures.

(66) Hofstede op cit Pages 247-262

(67) Hofstede op cit Pages 247-262

The data concerning frequency and usefulness of group meetings of the boss and his subordinate revealed that all in all, meetings have a more positive effect on the 'attitude' component than on the 'relevance' component of budget motivation. Though they are in many cases not indispensable (budget wise) nevertheless when these meetings exist, and are perceived to be useful, then they help to create a positive attitude towards the management accounting system. Reference has already been made to the work of Hopwood (68) in deriving relationships between different leadership styles of superiors in using budget information, and the degree of tension and frustration in subordinates. In order to determine the effect of leadership behaviours, as well as isolating the Budget Constrained style and the Profit Conscious style, he identified six other criteria of performance evaluation comprising co-operation with colleagues, getting along with the boss, effort put into the job, concern with quality, attitudes towards the work and ability to handle men.

Although it is the Budget Constrained style and the Profit Conscious style around which he draws his main conclusions, it should be pointed out that whilst there were 33 responses from subordinates where the Budget Constrained style ranked among the top three, there were as many as 74 responses which were classified as having a Non Accounting style of evaluation. The non accounting style implies that a low relative importance is attached to accounting criteria of performance i.e. that the two accounting related criteria were ranked below the top three and not that they were ignored completely.

The conclusions of the research indicate that questionable consequences such as job related tension and less favourable relations with peers and superiors only occurred when the superior used management accounting information in a Budget Constrained behaviour style of performance evaluation. The Profit Conscious style did not result in any easier job requirement - it was a demanding style and accompanied by financial tension - but a style which did not result in rejection of accounting information provided that the accounting information was used with care and that individual and particular budget variances were not over emphasised to the detriment of the subordinate's social profile.

These later and more detailed investigations of both Hofstede (69) and Hopwood (70) have yielded results which confirm the exploratory views developed by Argyris (71) in that the way in which use is made of management accounting information varies with different leadership patterns. The superior subordinate relationship in the field of management accounting information may be of such a nature that one of the adverse consequences of the relationship is manifest in that the information statement or budget becomes the object of blame and rejection, accompanied possibly by scapegoating.

The implication for this Work Measurement/Management Accounting investigation is that such superior subordinate relationships may act as an extraneous influence and confound or cancel the effect the independent variable, Use/Non Use of work measurement has on the

(69) Hofstede op cit

(70) Hopwood op cit

(71) Argyris op cit

perceived usefulness of management accounting information. The three components which operationally define this relationship emerge as being the comparative frequency of personal communication about budget figures and cost effectiveness (Question 7-08) the role of budget variance in the act of performance appraisal (Questions 7-09 and 7-10) and the frequency of group meetings (Questions 7-11 to 7-14).

TABLE 3

The Measurement and Coding of Properties of the Management Accounting System and Environment

Property or Element	How Measured	Method of Coding or Scoring
<u>Management Accounting Function</u>		
Timeliness	Frequency of receiving reports on time (Q. 7-18)	Higher scores on 1 to 10 scale indicate higher levels of timeliness
Relevance	Frequency of reports as relevant (Q. 7-17)	Higher scores on 1 to 10 scale indicate greater relevance
Understandability	Degree of clarity or confusion (Q. 7-19) Frequency of discussion with accountant (Q. 7-20) Extent of co-operation with accountant (Q. 7-21)	Higher scores on three 1 to 10 scales with overall range 3 to 30 indicate greater understandability
<u>Budget Standards</u>	Extent to which targets are loose or tight and reasons (Q. 7-06, 7-07)	Higher scores on 1 to 5 scale indicate rightness of targets plus verbatim comment

TABLE 3 (CONTINUED)

Property or Element	How Measured	Method of Coding or Scoring
<u>Participation</u>	Frequency of consultation with decision makers in setting targets (Q. 7-03) Influence of decision makers opinion (Q. 7-04) Influence of others opinion (Q. 7-05) Overall extent of Participation (Q. 7-02)	Higher scores on four 1 to 10 scales with overall range 4 to 40 indicate greater participation
<u>Superior/ Subordinate Relationship</u>		
Communication on accounting information	Frequency of discussion on cost effectiveness and of meeting budget targets (Q. 7-08)	Higher scores on two 1 to 10 scales with overall range 2-20 indicate more communication
Performance appraisal	Ranking of performance appraisal items (Q. 7-09)	Higher % of cost/ budget items ranked in top three indicates greater emphasis on accounting measures
Group discussion	Frequency and usefulness of budget results and reasons (Q. 7-12 to 7-14)	Higher scores on two 1-10 scales with overall range 2-20 indicate more group discussion plus verbatim reports

#### 6.7.6 Perceived Usefulness of Information on Raw Materials Issue

Management Accounting Systems Environment is a construct which endeavours to incorporate into the research design influences other than the experimental variable which might affect the systematic variance of the dependent variable. The ideal conditions for testing the hypotheses would be two groups of small business units whose states of Management Accounting System and Environment were equal so that changes in the perception of Usefulness of Management Accounting Information were seen to be associated only with changes in the Use of Work Measurement. It is not empirically feasible to generate two sample groups which are known to be equal in respect of this state of Management Accounting Systems Environment consequently the research methodological of variance control has been brought into play and any inequalities between the groups in this respect will, instead of being eliminated, be measured as extraneous variables.

If the inequality of the state between the groups is strong enough to influence the perception of one output of the information system, that concerning direct labour activity it might be reasonably supposed, that as a general characteristic, it would influence the perception of other outputs. If those other outputs were not associated with or dependent on work measurement, a measure of any variance between the groups of companies in the perception of such outputs would be some form of check on the effects or influences the extraneous variables were actually having on information output about direct labour activity. It would give further evidence as to whether changes in the perception of usefulness of direct labour information was mainly influenced by work measurement or whether inequality of the state of the Accounting System and Environment was also strong enough to have had an influence.

One output of the information system which might be expected to be sensitive to different states of the Accounting System and Environment would be that output dealing with measures of the use of services such as electric power or steam, another might be the measure of the use of raw materials, depending in each case on the relative ratios of cost. As the Furniture and Timber Industry is not seen as a process type industry and therefore less interested in service costs but more interested in raw material costs it is proposed to use the information output about material usage as an attempt to check on the effects of the Management Accounting System and Environment.

The particular materials information output chosen for this check is that dealing with the measures of raw material issue. This output is chosen because the technical or physical means on which the information output about material issues is based, such as weighing, counting, linear or cubic measurement, is assumed to be more consistent throughout various companies than measures concerned say, with yield of material, which might be affected by factors such as different policies or quality. Given this assumed consistency and the output basis of measurement having no relationship to work measurement any variation in the perceived usefulness of such information might reasonably be taken as means of isolating the affects of variations of the state of the Management Accounting System and Environment on the dependent variable.

The operational definition of this perceived usefulness of information about raw materials is appropriately taken as being the same

as that of the direct labour accounting information in having components of accuracy, comparability and objectivity. These are measured in the interview schedule by Questions 9-02 and 9-03 for accuracy, Questions 9-04 and 9-05 for comparability in relation to jobs and time, and Questions 9-06 and 9-07 in relation to objectivity.

## 6.8 Summary

In this chapter each of the constructs of the research design has been developed into one or more variables and questions designed to measure these. The Use of Management Accounting Information was viewed as an independent experimental and manipulative variable which was the first criteria for selection of the sample groups. The Use and Non Use of Work Measurement were the independent experimental variables which formed the main manipulative vector of the research design to be used to generate the two dichotomous sample groups. Moderator variables were also developed as extensions to these as measures of further possible systematic effects on the variance. An independent but not manipulative variable - Small Business Profile - was developed as a means of checking whether, apart from the dichotomous criteria, there was commonality between the two groups in such areas as technology of operation and type of production. The other main vector of the research design, the dependent variable Perceived Usefulness of Management Accounting Information, was then restated with its constituent properties of accuracy, comparability and objectivity, and innovative measures to assess these were proposed. Finally the construct Management Accounting Systems and Environment was developed as a series of extraneous variables whose presence might have a systematic but unwanted influence on the postulated relationships. These extraneous variables covered such areas as the Internal Functioning of the Accounting System, Participation and Superior Subordinate Relationships. A means was proposed to assess their effects by the use of a check variable which would measure the Usefulness of Accounting Information on raw materials issues.

## CHAPTER VII

### SURVEY RESPONSE AND GENERATION OF USE/NON USE GROUPS

7.0 This chapter is concerned first of all with the actual way in which the survey was carried out, and reports on the random sample generated by the response obtained from the North of England population of small business units in the Furniture and Timber Industry. It goes on to explain and discuss one of the key dimensions of the research project, that is the result of applying the independent variable measures to the sample as a means of creating a USE of work measurement group and a NON USE of work measurement group of businesses. The application of the Small Business Profile measure is analysed to check whether or not the two groups, dichotomous in their USE/NON USE states, were comparable in their industrial and business characteristics.

#### 7.1 Response

The collection of field data to test the hypotheses was initiated by sending a letter to the Training Officers of all the companies shown as having between 100 and 499 employees on the list of firms, as supplied by the Furniture and Timber Industry Training Board, of the Furniture and Timber Industry in the Northern Region. The letter sought co-operation in the research project, and in order to authenticate the approach, referred to the Furniture and Timber Industry Training Board, their Area Training Advisor and to the Small Business Centre at Durham University Business School. It stated very simply what the project was about and how it might in an overall manner help small businesses, stressed the confidentiality of company data, and indicated the workshop management experience of the researcher. It concluded by stating that the researcher would telephone the company shortly to discuss their possible involvement.

After an interval of about ten days the telephone approach referred to in the letter was made in order to find out whether the company would participate in the project. Although in some instances it was possible to find out the response immediately from the company there were many cases where the Training Officer, when this job was not carried out by the Chief Executive himself, had not yet obtained a decision one way or another from the Chief Executive. In some cases he had not had the opportunity to discuss the matter with the Chief Executive. This was not a precursor of a nil response but a reflection of the path of access chosen and the activity level of chief executives. This busy level of activity of chief executives was also a cause of delayed response from firms where the letter had gone straight to the boss. All in all a fair amount of delay was experienced and much perseverance was required in order to have the request considered for a decision by the appropriate people.

Of the total population of 40 firms on the Training Board's list 21 of these were clearly employing less than 100 employees leaving 19 whose labour force was probably between 100 and 499. As the responses accumulated and interviewing programme was being carried out, it became clear that the Northern Area of the Training Board was not going to generate enough small business units for each sample group. Eight of the nineteen firms declined to participate, three had already formed part of the pretest programme and two of the remaining eight were excluded after application of the independent variable questionnaire. It thus became necessary to consider extending the field study to other specific areas covered by the Training Board.

After consultation and analysing the experience of researcher in terms of time and cost effectiveness in the collection of data in the Northern Area and consideration of the overall time constraint on data collection it was decided to extend the field area to cover the Yorkshire Area and the Sheffield and Humberside Area of the F.T.I.T.B. The Yorkshire Area covered the Leeds, Bradford, Harrogate, Wakefield territory whilst the Sheffield and Humberside Area extended from Barnsley to south of Sheffield and the area to the east coast including the south bank of the Humber.

The total population of small business units from these three areas on the list of the F.T.I.T.B. whose labour force was probably between 100 and 499 was 60 of whom 28 were willing to participate in the research investigation. Of the 32 who were unwilling to participate, 2 firms had initially agreed but subsequent to participating in the first set of interviews using the independent variable questionnaire, they indicated their wish not to proceed to the second stage. The breakdown of the response from area to area is shown in Table 4.

TABLE 4  
Response Rate By Areas

<u>Area</u>	<u>Total Population of Firms</u>	<u>Unwilling to Participate</u>	<u>Willing to Participate</u>
Northern	19	8	11
Yorkshire	21	11	10
Sheffield Humberside	20	13	7
Totals	60	32	28

Bearing in mind that non response is a form of bias, to what extent did non response produce an unrepresentative overall sample of the Furniture and Timber industry? The nature of the manufacturing business carried out by responding firms was of course clearly set down in the replies to the independent variable questions. The manufacturing activity of the non responding firms whilst not accurately recorded, was in the main, discernable or logged during the telephone follow up of the original letter. Whilst this information has limits to its accuracy, it nevertheless could give broad indications of whether the responding sample was biased to one type of activity or another within the industry.

Table 5 is a sub division of all the firms approached in the Furniture and Timber Industry in the Northern Region into classifications which, although they are to some extent arbitrary, do distinguish between such different manufacturing activities as making upholstered furniture as against box or flat furniture or between making caravans and pencils. From examination of Table 5, which sets out the responses in relation to the classification groups, it seems that those companies who were willing to participate in the research were a reasonable spectrum of the Furniture and Timber Industry in the Northern Region.

TABLE 5Response Rate By Type Of Business

<u>Type of Manufacturing Activity</u>	<u>Unwilling to Participate</u>	<u>Willing to Participate</u>
1. Cabinet or flat type household furniture such as wardrobes, kitchen cabinets, tables	7	8
2. Upholstered household furniture such as beds, 3 piece suites	5	6
3. Contract furniture for institutions such as hotels or educational institutions	3	3
4. Joinery products such as doors, windows, packing cases and milled timber	8	7
5. Caravans	3	1
6. Small products such as brushes, pencils and wooden heels	4	2
7. Veneer or chipboard processing	2	1
	<hr/>	<hr/>
Total of Firms	32	28
	<hr/>	<hr/>

Why would firms be unwilling to participate in the research?

Again there was no means of knowing systematically the real reasons why companies declined but it was possible to log some of the overtly declared attitudes to the project. Many firms said they had "too much on at present" or were under pressure and didn't wish to take people off essential work. Most of the interviews were planned to take place during July and August and the interruption of the holidays was sometimes given as a reason. Intensive preparation for a trade show and some concern about leakage of trade secrets in a highly competitive environment emerged fairly clearly as reasons from caravan manufacturers. Two companies appeared to have a firm declared policy against any further involvement in research or project activity. Some companies did say with conviction that they normally did co-operate with external agencies in projects and investigations but were not able to do so on this occasion. Would companies have been "less busy" if they had seen more direct benefit to their own businesses? This clearly cannot be answered but two companies specifically indicated that as "There is nothing in it for us" they were not interested in participating.

The response of companies which has been summarised above for the whole population of the three areas actually occurred in three waves. The first wave of responses was received in early June and the second and third waves in early July and was in relationship to the despatch of the initiating letters. After the experience of the first mail shot into the Northern Area a modification in gaining access to the participation decision was made. The request for participation was sent direct to the chief executive of each company in order to eliminate any delay arising from the request forming just one of several tasks pressing on the

Training Officer. In spite of this direct approach in some cases personal contact with a chief executive was subject to quite a long delay, due for example to a holiday followed by an overseas visit, or a series of conferences and meetings and some individual responses were not available until early September.

## 7.2 Derivation of Groups

The decision to extend the survey to include the Yorkshire and Hudderside geographical areas of course meant that more time would be required for data collection than originally envisaged. The time involved in securing the further lists of companies and the organisation of the additional mailed letter approach together with the length of time experienced in contacting executives to arrange convenient interview dates had an effect on the planned methodology. Instead of applying the independent variable measures to all companies and then generating the two dichotomous groups from the completed total responses it became necessary to classify companies into USE/NON USE of work measurement or to exclude them, as and when the companies were visited, so that the next stage of measurement could be arranged. Thus in order to make efficient use of the researcher's time, the second stage of the data collection was embarked upon concurrently with some companies at the same time as arranging and waiting for first stage interviews with other companies.

The classification of companies as the data collection continued was not regarded as undermining the objectives of the design and structure of the research. The idea of generating a sample and then drawing some median type line through it, as a means of separating USERS from NON USERS had earlier been rejected in favour of the application of specific profile measuring gauges capable of placing

a small business unit in one or other of the two categories or excluding it from either at the time the gauge was applied. The summary of these classifications for the responding companies excluding the three companies from the pretest group, is set out in Table 6.

TABLE 6  
Independent Variable Groups

<u>Use of Work Measurement</u>	<u>None Use of Work Measurement</u>	<u>Firms Excluded</u>	<u>Total No. of Firms</u>
7	5	13	25

Thus approximately 50% of the small business units who responded favourably to the research project could not be used for measuring usefulness of **management** accounting information because the application of the independent variable questionnaire brought to light some feature which did not match the profile of either the USE or NON USE category. These criteria of exclusion in relation to numbers of companies are set out below.

TABLE 7  
Distribution of Exclusion Criteria

<u>Criteria</u>	<u>Number of Firms</u>
No Accountant	8
Work measurement recently implemented	2
Untrained work measurement practitioner	1
Intermittent use of work measurement	1
Company employing over 499 people	1
	<hr/>
Total	13
	<hr/> <hr/>

Not having an accountant was by far the most frequent reason for excluding companies from the second stage of the field research with eight companies falling into this category. One company although having used work measurement for some considerable time had only limited coverage of their operations by intermittent use, when for example they wish to check the justification of expenditure on machines or materials handling equipment. It was not used on a regular basis for compilation of budgets or operating statements.

Two companies had recently implemented or were in the process of implementing a system of work measurement and one company, although having originally implemented and operated work measurement using a trained work measurement practitioner, had since his departure six months ago used a person untrained and inexperienced in work measurement.

Although there were over 60% of the sample employing an accountant and using some form of management accounting system the eight firms not employing an accountant had a disproportionate effect on the potential size of the NON-USE group. As only one of these eight firms was using work measurement the potential size of the USE group was reduced by one only on this criterion but the NON USE group potential numbers were reduced by seven on the same criterion.

Having presented the overall picture of the derivation of the groups this chapter now proceeds with a detailed analysis of the various independent and moderator variables.

### 7.3 Independent Variable - Use of Management Accounting Information Systems

Apart from the title of accountant, persons responsible for management accounting in the 12 business units using management accounting systems carried such varied titles as finance director, company secretary, and administration manager. All of these "accountants" had many years of experience of cost control systems, seven of them having had from ten years to twenty years experience whilst five years was the shortest period of any personal experience. In some companies these accountants were solely responsible for management accounting but in the majority of companies they were responsible for both financial and management accounting systems, in which case they invariably had staff in their sub organisation whose sole function was some aspect of management accounting.

All the companies stated they were operating some form of management accounting budget on a monthly or four week period but in some cases this was an aggregate statement for the Board and chief executives. However, all companies had detailed statements of one form or another which provided information of anticipated planned or budgeted costs, and which generated figures of actual costs in relation to those budgeted. Half the companies provided this information on a weekly basis and the other half on a monthly basis. The statements took various forms and titles including production variance reports - output/budget statements, labour/materials/operating costs - factory performance statement. In only two companies was this information made available only to second line managers, in all other companies it was available to first line managers of varying titles such as head of department, supervisor, foreman, production manager, according to the varied

company organisations encountered. Standard costing was in full operating in only two companies and being developed in four others. None of the twelve companies operated a management accounting system which emphasised or depended upon information about actual against planned performance being expressed in unit output terms, as distinct from cost or value terms.

In contrast to the quite long periods of experience by accountants of cost control systems, the maximum period that a firm had been operating their current accounting information system was 7/8 years and six companies quoted two years, or just over, of operation of their systems. This would seem to suggest that a management accounting system was a comparatively recently adopted technique in these small business units and that accountants had moved into companies from outside experience. However, as the question asked covered the various means of management accounting information systems in total an additional interpretation was that companies had progressed in stages with the development of management accounting information systems and that extension into servicing first and second line manufacturing management was of comparatively recent origin. This was borne out to some extent by ad hoc comment from accountants.

In each of the twelve companies the management accounting information system was linked to some means of assessing the direct labour activity of production. This was either to work measurement or to some decision system separate from work measurement such as estimation based on technical knowledge, or using sub division of global historic data.

Each of these twelve companies then, matched the profile of being users of management accounting information systems on the criteria of having full time experienced management accountants controlling information systems, of at least two years standing, which provided budgeted and actual costs to production supervisors and managers at intervals of one or four weeks.

Although not a criterion of the independent variable it was found that five of the accountants had no form of qualification, four accountants were approaching or had achieved the final stages of the institute of Cost and Management Accounts Examinations. Three accountants including one of the latter were Chartered Accountants and one was a Chartered Secretary.

#### 7.4 Independent and Moderator Variable Use of Work Measurement

The chief executives of the seven companies in the USE group all commented to the effect that they made extensive use of work measurement throughout their factories. This was confirmed by further data from the work measurement practitioners whose replies indicated that throughout the sample group the percentage of direct labour output assessed by work measurement techniques ranged from 70% to 100% with an average of 88% of output covered by work measurement. Time study together with some standard data were the two forms of technique most extensively used, activity sampling was used by three companies but only to a minor extent and one company alone made use of a Predetermined Motion Time System in that about 20% of their output was assessed by the M.T.M. technique.

In the main companies were firmly established in their use of these techniques, the length of time they had been using the techniques to the extent indicated above ranged from 2 years to 15 years and the average length of utilisation was 7 years. In two cases companies were on a second generation system where they had refined earlier less sophisticated work measurement schemes. The company with the least length of experience in the use of work measurement was well staffed in its facility in that it was employing two practitioners each with over five years post training experience.

In terms of a link between work measurement and the management accounting information system, all the business units confirmed during this stage of the investigation that their work measurement

techniques were used as the means of assessing the anticipated or budgeted amount of direct labour activity in their operating or cost statements.

All the business units in the sample group were using one or more trained work measurement practitioners who were resident at that particular factory or works. Their training had taken place at Colleges of Further Education, Polytechnics, consultants residential work study schools, industry colleges or the M.T.M. Research Centre. The College training was mainly the Institution of Work Study Practitioners part-time course whilst the other institutions provided full time courses. The work measurement component of these full time courses ranged from three weeks to six weeks and in some instances both work measurement and method study had been undertaken by practitioners. In no cases had practitioners been trained exclusively within their own organisations.

The work measurement practitioners had all had substantial experience of work measurement subsequent to being trained and at the time of the study. This ranged from three years to eleven years and the average experience of the practitioners was  $5\frac{1}{2}$  years. They had also in the main had two or more years of industrial experience or apprenticeship before embarking on work measurement training. Three practitioners from a total of nine had no previous industrial experience but two of these had been practitioners for six years and the third was the number two practitioner in a company and had had three years experience.

The responses from the USE moderator variable questions indicate that from a personal skill point of view 55% of the work measurement practitioners had participated in some form of check or assess-

ment of their rating skills. These had been carried out sometimes within the company and sometimes at external agencies using films or dynamic models.

As far as their organisational status was concerned the main tendency was for the practitioner to be responsible to a works manager, director, or to a staff executive level with the works manager. In only two cases were they responsible directly to the chief executive. The ratio of work study practitioners to total number of employees ranged from 1 : 106 to 1 : 200.

In terms of methodology all but one company stated that they reviewed the performance indices of operatives on a regular basis and as one practitioner commented "anything that looks silly is acted on." However, the responses of firms to the question on the number of jobs remeasured and the associated reasons suggested that the main reason for re-measuring was change in method or specification. The initiative to re-measure because of operator performance when it did arise, was from operator complaints rather than systematic management concern. In two companies however, complete re-measurement had taken place either throughout the factory or in a whole section because of drift in operator performance.

Examination of descriptions of jobs or methods associated with measured values indicated on the whole a high level of adherence to accepted work study procedure involving element breakdown, the use of rating and relaxation allowances, some of the latter being constant rather than variable, and a high standard of recording of job definitions.

As far as the climate of opinion in which the systems operated was concerned small business units either reported that at the most a very few number of their supervisors had attended appreciation courses (5 firms) or that none of their staff had attended courses (4 firms).

This particular group of business units appeared not to be different from others reported on by Reuter (1) as far as rating skills were concerned and in terms of occupying a central place in the organisation they were comparable to those companies analysed by Bevis and Collier (2) in having work study departments responsible to Works Manager level or above. They had a higher ratio of work measurement practitioners than the one work study practitioner to 260 employees found by Bevis & Collier (3) or the 1 : 280 workers found by Minter (4). These practitioners were seen to be adhering closely to accepted work study procedures and were re-measuring tasks when method changes took place if not in relation to the high expectation of Bevis (5) who called for frequent re-measurement of repetitive tasks. The comparatively low incidence of appreciation

- (1) V.C. Reuter. Work Measurement Practices. California Management Review 1971 part 14 Pages 24 to 30
- (2) F.W. Bevis & P.I. Collier. An Industrial Survey of Work Study in Wales 1963/65 - an unpublished paper Welsh College of Advanced Technology Page 13
- (3) Ibid Page 12
- (4) A.L.Minter A Critical Analysis of Work Study. Unpublished Thesis. M.Sc(Eng) University of London June 1967 Page 3.
- (5) F.W. Bevis "An exploratory study of industrial learning with special reference to Work Study Standards" Unpublished M.Sc Thesis U.W.I.S.T. 1970

courses for supervisors and managers suggests that the environmental climate in which work measurement systems were operating was not influenced in their favour by such a criterion.

It was considered that there was not a lack of sophistication in the work measurement systems throughout the group sufficient to produce a negative effect on the systematic variance of the dependent variable, although one particular company was below the norm of the group in three of the criteria referred to. There were a number of indications of a higher level of sophistication of the technique, but considered on balance, not enough to have a reinforcing effect on the systematic variance of the USE group. Nor was there any individual firm which exhibited higher standards than the norm across all the criteria referred to.

### 7.5 Independent and Moderator Variable Non Use of Work Measurement

The chief executives of the 5 companies in the NON USE group of the sample spoke of using methods of assessing direct labour activity which did have differences one from another, but not to the extent that their various descriptions or titles suggested. These included observation by management, estimation, historical records, set historical formula, percentage of sales value, "We know what the operatives can do" and data bank records. There was however, a three part theme discernable in these variations:- estimating job by job using personal experience; estimating using historical records; and application of a ratio type formula to the sales value of work planned. The persons making these assessments were stated to be works managers, production managers, supervisors, estimators and accountants. All the chief executives indicated that these methods and people were used in the process of establishing budgeted, or anticipated, direct labour costs in operating or cost statements, thus confirming the existence of a linkage between this assessment and the management accounting information system.

In three of the firms the foregoing responses referred to the whole of the establishment but in two companies there were parts of the factory to which these responses did not apply as the companies were using work measurement to a limited extent. Application of the questionnaire to gauge the USE of work measurement state, indicated that some specific sections only of both companies, the sewing of upholstery textiles for example, were covered by work measurement. In each firm this application of work measurement covered about 25% of the factory and some of it was in the developmental stage.

Before making a judgement about the retention or exclusion of these respective companies it was necessary to make further enquiries and to consider the moderator variables. Further investigation revealed these work measurement applications to be not only confined to geographically separate sections of the factory but as measuring systems they stood organisationally on their own, separate and apart from those measurement systems which used estimating and historical data. The separation was derived to some considerable extent from the very nature of the need for careful and controlled introduction of such a technique and the associated understanding with the labour force. The responses from the moderator variable questions confirmed that the NON USE system of measurement covered at least 70% of the work force in each separate section and that the work measurement system did not intrude into the NON USE system. It was decided then to retain the two companies in the classification and to apply the dependent variable measure only to those major areas of the factories where NON USE prevailed. Examination of the responses of the moderator variable questions of the other three companies indicated between a 75% and 90% coverage of the direct labour output by NON USE methods and that for the remainder of the output no assessment was made at all.

The questions to the production managers estimators and others involved in assessing direct labour content confirmed the earlier statements of the means used and in some cases elaborated on these methods. There were several references to long experience of the industries, tasks, or specific trades as a basis of assessment. There was also a specific instance of isolating tasks relating to an arm, leg or other component of a furniture piece and of making comparison with other similar components rather than with the piece

of furniture as a whole. Such a method of assessment was at the opposite end of the spectrum to the macro approach of taking a percentage of sales value (a percentage changing in the light of actual results) or the even less sensitive method of using a constant rule of thumb ratio of sales value as the measure.

In the main job sheets, job cards or cost sheets were available as a basis for assessment but in only two instances were detailed lists of times in relation to particular tasks, components or machines, prepared and used.

There was one instance of timing and that was with a wrist watch and in that same company a fixed allowance was made for relaxation and contingencies. An arbitrary allowance was made in another company, explained as "If the time for a job or batch is estimated at 25 minutes, then we give him 30." There were two instances where the operatives themselves participated in the measurement system by agreeing to or seeking modification of the values derived by the assessors.

The responses about personal skills and experience of assessors of direct labour activity as a potential moderator influence revealed a production manager who had had earlier previous experience on time study working alongside consultants; he also had undergone a work study course of approximately 4 weeks. Two other people had attended work study appreciation courses of a few days duration. None of the accountants involved in calculating direct labour activity had had either experience or training in work measurement. No-one at all had attended any training courses in estimating, they had acquired this skill by experience or from other senior colleagues.

Most of the works managers, production managers and estimators had had extensive experience within the industry and half of those interviewed actually quoted the length of this as between 13 and 30 years. Although age was not asked for in the questionnaire the interview method enabled the researcher to observe that all the respondents were in the age group of around 35 upwards which together with having spent most of their working life in the furniture and timber industry, gives an indication of the depth of their experience. This experience ranged from skills and crafts such as frame making, upholstering, bench joiner and mill machine operator, through supervision, storekeeping and sales representation, to the jobs they were presently carrying out.

From this data on the skills and experience of these assessors of direct labour activity then, it seems there is no lack of competence, which, had it existed, would have had a negative effect on the systematic variance of the dependent variable. This view takes into account the absence of attendance at any training courses in estimating, a feature which could be interpreted as an inadequacy in the skills profile of this age group. A more probable explanation however is that such courses do not appear to be a normal feature of, preparation for, or continuing with, this assessment task.

On the other hand, the presence of some timed observation of operator performance, the use of comparison of elemental data and some use of allowances, together with some experience of and training in work measurement might well result in having a positive effect on the systematic variance of the dependent variable. However, as

none of these features appear consistently throughout the group of NON USE companies, any such effect on the group is likely to be minimal. Where two or more of these features are found within one firm, however, some positive influence on the dependent variable readings in that company might be expected.

## 7.6 Independent Variable Small Business Unit Profile

The furniture and timber industry was selected as a particular industrial segment which would generate two sample groups of small business units which were comparable with each other in normal business and industrial characteristics. The construct Small Business Profile was incorporated into the research design in order to measure whether, after the two groups had been generated by the application of the independent experimental variables, like was being compared with like in terms of business characteristics.

The first characteristic reviewed is that of product areas manufactured by companies in the groups. Business units of both groups are arranged in Table 8 by their products in such a way that same products are opposite each other and similar products are arranged near to those in the other group. In each case the mode of manufacture is stated.

It can be seen that the range of products from one group to the other is reasonably close. Both groups have sawn and milled timber, roof trusses, 3 piece suites and kitchen units and cabinets as common products. Although there are no divans, beds or mattresses made in the NONE USE group the basic process used that of cutting and machining timber to size, frame making, and upholstering is very similar to that carried out by the manufacturer of three piece suites. Again, Company J is similar to Companies A and H in that, it converts basic raw material into a saleable product with few operations and low added value, and is involved in small batch and jobbing activity. The commonality between the box type bedroom furniture manufacturer and the caravan unit lies in high speed assembly operations. However, whereas the caravan manufacturer

buys in a large number of components ready for assembly, there are several high output machining processes in the preparation of the bedroom furniture.

TABLE 8

Comparison of Products and Production Modes  
Between USE and NON USE Groups

<u>USE GROUP</u>			<u>NON USE GROUP</u>		
<u>Co. Ref.</u>	<u>Product</u>	<u>Production Made</u>	<u>Co. Ref.</u>	<u>Product</u>	<u>Production Made</u>
A	Sawn and milled timber. Roof Trusses	Small to medium batch Some Jobbing	H	Sawn and milled timber Windows, doors, staircases Roof Trusses	Small to medium batch Some Jobbing
			J	Application of laminate to chipboard. Packing cases - palletizing	Medium batch Jobbing to small batch
B	Three piece suites	Large batch in timber preparation. Medium batch in assembly	K	Three piece suites	Medium to small batch
C + D	Divans, beds and mattresses	Large batch preparation Medium & small batch assembly			
E	Kitchen units and cabinets	Large batch preparation medium batch assembly	L	Kitchen units and cabinets	Small to medium batch
F	Specialised institutional furniture, mainly benches and cupboards	Small batch and Jobbing			
G	Panalled and bedroom furniture (box type)	Medium to small batch	M	Caravans	Medium to large batch

The classification of modes of production, as had been expected, was not as straightforward as recording products made or the size of company and the resulting classification is not solely the perception of chief executives. In some cases, the mode as recorded at the first interview with the chief executive, was amended in the light of judgement based on observation on the factory floor. For example, the classification of a NON USE company was altered from medium batch to small batch, also large batch preparation was added to two of the USE companies.

Reviewing the classifications in Table 8, it can be seen that in the USE group there are examples of large batch production in the preparation of timber prior to assembly which are not found in the NON USE group. This arises from some business units limiting their range of a product coupled with the normal tendency for some components going to different assembly batches to be identical, or if not, to have the same operations carried out, such as edge bonding or machining of standardised finger joints. Even taking this into account, it can be seen that no single production mode dominates either group and that medium batch, small batch and jobbing modes of production are spread throughout both groups.

As far as market environments are concerned, both groups of business units serve such markets as the building and construction industry, local authorities, retail outlets, and non consumer markets such as industrial companies and institutions. Any difference between the groups in terms of markets lies in the larger proportion of companies - four out of seven in the USE group selling consumer products through retail outlets. These are the furniture makers,

and there is only one such maker in the NON USE group although the caravan manufacturer is also serving a consumer market. Though not specifically measured there was some suggestion of a keenly competitive environment in these consumer markets.

Turning now to the question of size, whether measured by numbers of employees or by sales turnover, the USE group contained some larger companies than did the NON USE group. In terms of the total number of employees in the business, the size of the five companies in the NON USE group ranged between 100 and 200 employees whilst the USE group had four units between 100 and 200 and three units between 200 and 400 employees. In terms of sales turnover, the NON USE group ranged from £1M to £3.2M and the USE group from £1M to £4M.

There were considerable intra group differences in the ratio of labour to material cost according to product area. For example, there were two companies in the NON USE group who converted, with only a few operations, raw timber into dressed timber, coated timber or boxes and roof trusses as their products, with ratios of between 1 : 7 and 1 : 9. The other companies, however, who were making finished products for sale were distinctly more labour intensive with labour to material cost ratios of between 1 : 2 and 1 : 4. In the USE group the supplier of dressed timber and roof trusses had a ratio of 1 : 8 whilst most of the finished product companies making various types of furniture ranged from 1 : 3.0 to 1 : 3.6 in their labour cost to raw material cost ratio. Hence the groups were not dissimilar one with another in that they each contained two distinct levels of labour to raw material cost which are comparable on an inter group basis.

As a number of units on the list of small businesses provided by the F.T.I.T.B. were known to be subsidiaries of larger companies it was necessary to check on the nature of relationship with the parent company in order to determine whether the businesses unit could be regarded as a small business for the purpose of this research. Of the five NON USE companies two were owned by parent companies or groups of companies though these parents were not of themselves very large companies. In the USE group however, no fewer than five of the seven companies were part of such larger groups who employed between 2000 and 5000 people with turn-overs between £16M and £100M. These particular subsidiary companies however, were not the largest in the USE group as both the companies employing over 300 people were independent companies, one with subsidiaries of its own. As individual companies however the subsidiaries were independent business units usually with their own board of directors and operating as decentralised organisations who acquired raw material processed it into a finished product which was sold direct to a market.

The particular organisational links which might have affected this research were those in the functions of management accountancy and work measurement. In the event all the work measurement officers were completely responsible to senior executives at each unit rather than to some centralised management services section. Again, all the management accountancy sections were self contained in the various USE group business units, the relationship with group accountants being mainly in terms of financial accounting or of broad policy. The one instance where the accountant was not located at the unit was in a NON USE company where the not very large parent company was located in the same city.

Considering the results of several of these measures together, coupled with visual observations of the researcher, enables a view to be developed of whether there were marked differences in the technology between the two groups. One reason for conducting the field survey within one industry was to avoid generating two groups who were individually dominated by different technologies of manufacture such as the fabrication and machining of steel products on the one hand and say, food processing on the other. The survey has in fact, revealed that there were no outstanding differences in the technology of manufacture adopted by the two groups. There was a common process of cutting linear or panel timber to size, machining or shaping it to a detailed form, often incorporating at some stage a coating process using veneer or plastic, followed finally by assembly. In the case of upholstered furniture, fabric was cut and sewn into detailed form before being incorporated in the final assembly operation. Where larger batches were being processed, some of the machines or equipment were larger or faster in operation than others but the technology was, in essence, the same.

A rigorous search for any possible indications of lack of comparability between the groups does bring out a number of points for consideration. The USE group has more upholstered furniture products, some instances of larger batches of production, and a slight tendency to labour intensive rather than material intensive activities. Most of the companies in the USE group are subordinates of larger companies. Two companies though not in this majority, being independent companies, are considerably larger than any in the NON USE group. However an apparent lack of

comparability on the grounds of a small business unit being really part of a big company is largely counterbalanced by the geographical separation and organisational autonomy seen to exist with these units. The other indications are judged as being minor variances from the norm and weighing them in the balance leads to the conclusion that any other industry chosen would probably have had a similar variety of products and company size and that any differences between the USE and NON USE groups are of a moderate degree to the extent that they do not dominate a particular group.

Conducting the survey within the Furniture and Timber Industry then has empirically generated two groups whose products, technology, mode of production and other business characteristics are similar from one group to another. The construct Small Business Profile, an independent but not experimental or manipulative variable, has shown that in this study like is being compared with like in terms of typical industrial characteristics. It can be concluded that in terms of variance control differences in those factors deriving from industrial characteristics which might have influenced the dependent variable in an unwanted manner have been minimised in that two comparable groups of companies have in fact emerged from the Furniture and Timber Industry.

## 7.7 Summary

This chapter has explained the method of approach made to small business units in seeking their co-operation in carrying out the field survey and has set out by area and by type of manufacture the response obtained. The overall response from the region extending from the Humber to Northumberland and across to Cumbria was that 28 companies or 46% of the Furniture and Timber Industries Training Board listed firms were willing to take part in the survey and that these companies were a reasonable spectrum of the listed firms. The application of the independent variables to this sample generated 7 companies who matched the USE of work measurement profile and 5 companies the NON USE profile. The most noticeable effect of applying the experimental independent variables was the exclusion of 8 companies from further study because they were not using management accounting techniques. As in the main they were also not using work measurement the effect of this was to reduce the size of the NON USE group compared to the USE group. The moderator variable measures indicated that for each group as a whole there was likely to be a negligible effect on the systematic variance of the dependent variable from either a higher or lower level of sophistication in the USE or NON USE state of work measurement. Application of the Small Business Profile independent variable indicated that, in terms of variance control, differences in industrial characteristics which might have influenced the dependent variable in an unwanted manner have been minimised in that two comparable groups of small business units have in fact, emerged from the furniture and timber industry.

## CHAPTER VIII

### DECISION MAKERS PERCEPTION OF THE ACCOUNTING INFORMATION

8.0 This chapter is concerned with another of the key pivots of this research design, the survey results of the decision makers perception of accounting information. It deals with this in three parts; the analysis and presentation of the survey data measuring the dependent variables, a discussion of these results and thirdly, a consideration of the survey results in the light of the presence of moderator variables.

#### 8.1 Dependent Variables - Findings

The analysis of collected data which is presented in the first part of this chapter is that data measuring the dependent variable - perceived usefulness of management accounting information by decision makers. The construct, usefulness of management accounting information, is in this research derived from properties whose presence has been seen as sending a management accounting information system more beneficial or useful to decision makers. The properties were classified in Chapter II as accuracy, comparability and objectivity, properties which could be observed as variables existing to some degree or other within information systems for decision makers. The change in the existence of these properties is hypothesised as being related to the use of the technique of work measurement. The existence of these properties of usefulness in the USE group sample of small business units and the NON USE group has been measured in the field collection of data and the results are now presented under the respective property headings, starting with accuracy.

### 8.1.1 Accuracy

Accuracy within a management accounting information system, as has been shown in section 2.6 and 6.6.1 is compounded of reliability and precision. In this study one component measure of reliability was the difference in the perceived proportions of assessments of direct labour activity regarded as being over estimated or under estimated in relation to the actual direct labour activity required in practice.

Each decision maker had divided the total number of assessments into 3 proportions:

- (i) the % over estimated
- (ii) the % under estimated
- (iii) the % regarded as being accurate

As the percentage regarded as being accurate is, per se, neither above nor below the in practice value, the difference in the proportions (i.e. the reliability measure) is the smaller percentage of (i) or (ii) subtracted from the larger percentage.

Thus a decision maker who thought that:

- (i) 55% of assessments were over estimated
- (ii) 40% of assessments were under estimated
- (iii) 5% of assessments were accurate

would have perceived proportions resulting in a difference of 15% between over and under estimates. The calculated differences arising from the perceptions of individual decision makers were grouped into class intervals of 10% and the numbers of decision makers whose differences in percentages of assessments fell within each class interval is set out in Table 9.

Table 9 indicates an interesting contrast between the two groups in this reliability measure of differences in percentages of assessments over/under estimated. Thus although there were 9 USE group decision makers whose difference in proportions of assessments over/under estimated was less than 10% there were only 4 decision makers in the NON USE group whose differences in proportions were as low as this. The table indicates that the USE group either tended to have perceptions resulting in a distinctly high component of reliability i.e. a small difference in the percentages over/under estimated, or they are at the other extreme and had perceptions resulting in a distinctly low component of reliability.

This low reliability is indicated by the 5 decision makers whose perceptions of proportions was such that the difference in these proportions was over 71%. Examination of the detailed tabulation of responses shows that these 5 decision makers in the main considered that in their experience a large majority of the assessments of direct labour activity were on the high side of the in practice value (the 'bulls eye') - 3 of the 5 thought that virtually 100% of the assessments were an over estimate. To what degree they were an over estimate is of course, measured by the proximity component of reliability.

Detailed responses showed that the high reliability indication from the 9 USE group decision makers arose from several of them taking the view that a very large proportion of assessed values coincided with the correct or in practice value leaving only a small proportion more or less evenly balanced above and below

the line. The detailed responses of the NON USE group decision makers in contrast showed that their lower differences tended to arise from nearly even proportions under to over estimated with fewer assessments coinciding with the in practice value.

TABLE 9

DIFFERENCES IN PERCENTAGES BETWEEN OVER/UNDER ASSESSMENTS OF LABOURACTIVITY

Differences in Percentages of Assessments	Numbers of Decision Makers	
	Use Group	Non Use Group
0 - 10	9	4
11 - 20	-	1
21 - 30	-	2
31 - 40	-	1
41 - 50	-	2
51 - 60	-	-
61 - 70	1	1
71 - 80	2	3
81 - 90	-	-
91 - 100	3	-
TOTAL	15	14

Having looked at one component of reliability, analysis now proceeds of another - the proximity component. Although in designing the questionnaire it was necessary to position the proximity component of reliability further on and following the measurement of precision, in this discussion the results of the proximity measures are appropriately analysed now following on those results relating to differences between over/under assessments. Bearing in mind that higher scores indicate closer proximity of the average of variations in assessments to the in practice value, i.e. more reliability, Table 10 shows the number of decision makers in each group who recorded the respective proximity scores.

60% of decision makers in the USE group had scores between 7 and 10 on the scale arising from their view that the average of the variations was "close" or "very close" to the in practice value as against 21% of decision makers in the NON USE group with the same perception. No decision makers from either group considered the average to be a "long way out" but 28% of the NON USE group and 18% of the USE group scored 4 from perceiving the average to be "some way out".

The central tendency of the perceptions of the USE group of the closeness of the average of the assessments to the in practice value was higher with a median proximity score of 7.5 than that of the NON USE group whose median score was 6. The difference between the higher level of the scores of USE group decision makers over the scores of NON USE group decision makers indicating greater reliability of USE group assessments is significant at  $p < 0.5$  based on the Mann Whitney U. Test.

TABLE 10

Proximity Scores of Decision Makers

* Proximity Scores	Nos. of Decision Makers	
	USE Group	NON USE Group
10	2	
9	4	1
8	2	2
7	2	1
6	2	4
5	1	2
4	3	4
3		
2		
1		
TOTAL	16	14

\* NOTE: Higher proximity scores indicate a closer proximity of the average of the variations in assessments than lower scores, to the in practice value of direct labour activity than do lower scores

Precision as a component of accuracy in direct labour accounting information is the extent to which assessments vary from job to job in relation to the mean value of these variations. What has been measured in the field survey is the extent to which each decision maker perceived the variations in these relationships to be scattered widely or clustered closely around their mean.

Bearing in mind that a lower variation score indicates a narrower variation and hence a higher level of precision, Table 11 shows the number of decision makers in each group who recorded the respective variation scores.

56% of decision makers in the USE group thought that from job to job there was a narrow or very narrow variation in the assessments with scores between 4 and 1 as against 26% in the NON USE group with the same perception. On the other hand there were 5 decision makers or 35% of the NON USE group as against 1 decision maker in the USE group who thought that there was a wide or very wide variation, with a score of 7 to 10, in the assessed values of direct labour activity from job to job.

The central tendency of the perceptions of the USE group of the variations with a median of 4, indicated a closer clustering of assessments around the mean of the assessments than was the case with the NON USE group with a median score of 6. The difference between the variation scores of the USE and NON USE groups indicating greater precision of the USE group assessments, is significant at  $p < 0.01$  based on the Mann Whitney U Test.

TABLE 11Variation Scores Of Decision Makers

* Variation Scores	Nos. of Decision Makers	
	USE Group	NON USE Group
10		1
9		-
8		2
7	1	2
6	1	6
5	4	-
4	5	2
3	2	1
2	1	
1	1	
TOTAL	16	14

\* NOTE: Lower variation scores indicate a narrower variation or higher precision than higher scores in the assessment values

The reasons given by two of the USE group decision makers for medium or wide variations in values suggested that conditions might have changed in small but important ways of benefit to the operator or that operators through lengthy experience of particular tasks were able to complete them in much shorter times. There was also some suggestion of operator pressure, at certain times, to have loose values established for particular jobs.

From the NON USE group some reasons for wide variations related to the experience of people on the one hand and the measurement task itself:-

"Experience of managers or supervisors is not always reliable"

OR

"Some jobs or batches difficult to assess from experience"

There were other comments related to the methodology of assessment:

"The system doesn't take into account difficulties of different jobs"

OR "The ratio of labour to sales is a crude measure - not consistent"

AND "Because the sales invoice does not really reflect work that goes into a job"

There was an indication of the effect of time on assessed values and also some pressure by management in:

"On some jobs operators seem to have learned to do tasks quicker. On others we are rather tight."

OR "Some of our key times have drifted"

AND "Our machine times may be out of date"

A combined indicator of both precision and reliability was the proportion of the jobs or operations having assessments which were neither an over estimate nor an under estimate but were perceived as being an accurate estimate of the direct labour

activity required in practice. The proportion of jobs viewed as being accurate by decision makers in the USE group ranged from 0% to 100% and the average of these percentages was 53%. NON USE decision makers had a less wide range at 10% to 80% but a lower average of 33% of jobs perceived as having accurate assessments.

TABLE 12

JOB COMPARABILITY SCORES OF DECISION MAKERS

* Job Comparability Scores	Nos. of Decision Makers	
	USE Group	NON USE Group
10	1	
9	8	
8	2	
7	2	5
6	2	2
5	1	4
4		1
3		2
2		
1		
TOTAL	16	14

\* NOTE: Higher job comparability scores indicate information to be more useful than lower scores do when comparing jobs

Table 13 shows the results when decision makers were asked to what extent they found the assessed figures in operating statements to be a reliable guide when comparing direct labour activity from one week or month with another. Over 90% of the decision makers in the USE group perceived them to be "often reliable" or "very often reliable" (scores 7 to 10) whereas the percentage of the NON USE group with the same high perception of comparability was 28%. Whereas there was 50% of the NON USE group who thought the operating statement figures to be "seldom" or "very reliable" (scores 1 - 4) there was no-one at all in the USE group who perceived the comparability facility to be so low.

With a median comparability index of 9 the USE group perceived the management accounting information to be a more reliable guide when comparing time periods than did the NON USE group with a median index score of 4.5. The difference between the job comparability index of the USE/NON USE groups is significant at  $p < .01$  based on the Mann Whitney U Test.

TABLE 13

TIME COMPARABILITY SCORES OF DECISION MAKERS

*Time Comparability Scores	Nos. of Decision Makers	
	USE Group	NON USE Group
10	3	
9	6	1
8	4	1
7	2	2
6	1	2
5		1
4		1
3		4
2		1
1		1
TOTAL	16	14

\*NOTE: Higher time comparability scores indicate information to be more useful than lower scores do when comparing time periods

### 8.1.3 Objectivity

The third property of usefulness that of objectivity, is concerned with the impartiality and freedom from bias existing in the methods of assessing direct labour activity in that the most useful management accounting information would have been derived by methods which were least influenced by personal opinion and judgement. Decision makers were asked whether they thought the methods of assessing direct labour activity were completely impartial and if not the extent or degree of bias they perceived to exist in these methods.

The responses were coded to give an objectivity index ranging from 1 for "a great deal of bias" through to 11 for "completely impartial", and the respective numbers of decision makers scoring each level of the index is set out in Table 14. The median index in the USE group was 8.5 and that of the NON USE group was lower at 6. Table 14 shows that whereas no decision maker in the NON USE group perceived the methods to be completely impartial, 6 decision makers or 37% of the USE group thought this to be so of the methods in their units. Five decision makers or 31% of the USE group and eight decision makers or 51% of the NON USE group thought there was "some bias" or "considerable bias" in their respective methods.

Those decision makers who did not perceive the methods of assessment to be completely impartial were asked whether the bias they had registered was favourable or unfavourable towards the production department. Only 2 decision makers in each of the groups thought the methods were biased unfavourably towards the production department. 84% of the NON USE group and 50% of the NON USE group thought the bias was favourably to the production department.

The difference between the objectivity index of the USE/NON USE groups is significant at  $p = .025$  based on the Mann Whitney U Test.

TABLE 14OBJECTIVITY SCORES OF DECISION MAKERS

* Objectivity Scores	Nos. of Decision Makers	
	USE Group	NON USE Group
11	6	
10	1	2
9	1	1
8	2	1
7	1	2
6	3	3
5	2	1
4		3
3		1
TOTAL	16	14

\* NOTE: Higher scores indicate higher levels of objectivity in management accounting information

#### 8.1.4 Usefulness of Information - Open Comment

Overall comments were obtained by managers, supervisors and chief executives on how useful to decision makers was the management accounting information about direct labour activity which was contained in the operating statements, also whether they thought any different means of assessing anticipated direct labour requirements would provide more useful information for decision makers.

A number of comments were received from NON USE decision makers on the lines of:

"It (the information) is generally very useful"

OR "For the size of company we are, the system works well".

Some qualification in terms of mode of production from a manufacturer where batches were inclined to be small, was evident in the comment that:

"In this type of work we have to accept that the information can't be hard and fast".

There were some qualified responses which suggested that the information was satisfactory to work with even though it lacked accuracy. Some awareness of how the NON USE basis of information might be dependent on particular people was expressed in:

"The usefulness could vary with the person making the judgement. Anyones guess might be different".

Limitations of the information were clearly evident in such comments as:

"Gives a rough guide but we have to adjust a lot to produce our budget schedule"

OR "We have to try and balance good jobs with bad jobs in a given week using different information i.e. our own experience, in order to avoid the output figures jumping up and down."

This was a reference to excessive variance against budget when the measure used was sales value. There were other comments about the need for production decisions to compensate for inaccurate information, including :

"Product mix decisions are more complex than they need to be. In addition to consideration of such factors as customer priority and machine capacity it is necessary to compensate for the inaccuracy of the information from the measurement system."

One manager illustrated how he could be unfairly criticised as a result of a measurement system based on sales value when, following decisions aimed at meeting sales value targets, his contribution statement to budget sales was commented on as follows:

"You have reached your target but your wages have shot up".

Both a comment and an expressed need for change came from one decision maker:

"We should be progressive because the existing system doesn't really tell us what we need to know about a fair number of jobs."

There were only three respondents in the NON USE group who thought that no other different means of assessing anticipated direct labour requirements would provide more useful information:

"Experience is a great thing and better than anything else"

"Our work is of a flexible nature changing from one batch to another - standard systems wouldn't work"

"Such a peculiar industry I don't think there is any other way of doing it. Every job is different."

There was a considerable majority of respondents in this group however who did think a different means of assessment would provide more useful information with such comments as:

"We are looking for a better means based on unit work per component"

"I want to take work study into parts of the factory where work cycles are short such as bench work, cabinet making and sub section components."

"More use of standard data charts instead of one person's judgement out of his head. Use of work measurement."

From the small business unit which uses a wrist watch for timing some jobs came the comment:

"Any system which took setting up times and sharpening times would be more precise. More time needs to be spent on observing to make sure how long an operation takes - to take account of variations in time for the same job (i.e. cycle)"

There was a large majority of respondents from the USE group who considered the information about anticipated labour requirements in operating statements to be extremely useful including such comments as:

"Additional benefit is that I know which work centre to concentrate decisions on"

"Very useful measure - once you see it in black and white it gives you a good comparison for action."

"Extremely useful - deviation from norm prompts action"

"I can gain an idea where the problems are"

Two comments made comparisons with other experience viz:

"One of the best methods I have seen particularly with the type of labour we have got i.e. semi skilled with little craft tradition"

"I worked before in a department which didn't have work measurement and there I seemed to have little control".

## 8.2 Discussion of Dependent Variables

### 8.2.1 Accuracy

Moving from a presentation of the survey data to a discussion of the results this examination starts by considering the property of accuracy. Where the two indicators of accuracy, precision and reliability, came together in the % of assessed values regarded as neither being an under estimate nor an over estimate, the USE group clearly perceived a higher proportion of jobs falling into this category. Again in one aspect of reliability, the proximity

of the average of the assessments to the actual level required in practice, the USE group viewed these averages to be closer than did the NON USE group. USE group decision makers also thought the precision element of accuracy in their information to be stronger than the NON USE group did. They viewed the variations in assessments from one job to another to be clustered more closely to the mean of the assessments than did the NON USE group.

As far as the other component of reliability, the % difference of values above and below the correct value or bulls eye, was concerned, the averages of the differences are very similar to one another at 35.3% for the USE group and 36.9% for the NON USE group. Examination of the distribution of these differences reveals that these similar averages arise from quite different distributions from one group to another. The NON USE group had some decision makers who perceived the % of assessments to be more or less evenly balanced, above-below or coincident with, the in practice value i.e. resulting in a difference between the above and below proportions of less than 10%. With most of the NON USE decision makers however, the proportion of assessments lying above the in practice value compared to the proportion lying below was such that the differences between these proportions was fairly evenly distributed between 11% and 80%, as shown in Table 9.

There was however, quite a different pattern of distribution, one of bimodal form, seen within the USE group. Nine decision makers thought the proportions of high and low assessments were such that differences between them were less than 10%. The other six thought that the great majority of their assessments were high - thus producing comparatively large differences between above and below

percentages. This then was indicating a very high reliability component on the one hand and a very low reliability component on the other. It is appropriate to ask whether these six USE group decision makers were inclined to exaggerate their views when answering the question relevant to this particular indicator. There is evidence to suggest that this is not the case. The corroborative evidence which aligns with the perceptions of these six decision makers is that all these particular decision makers had, in response to questions about objectivity, recorded high levels of bias in the assessment technique, and in a direction favouring the production department. This suggests that the appropriate interpretation of the data is not that a considerable number of USE group decision makers were exaggerating, but there are in fact several situations where the majority of work measured values are an over estimate of the work actually required in practice. The measurement of precision by the variation score and of reliability by the proximity score, of course, shows that ALL the values in the USE group, including those perceived by the six decision makers referred to, are clustered more closely around their means and that these means are closer to the in practice value than is the case with the NON USE group.

It was seen in section 2.6 that accuracy in management accounting information is a particularly useful component for decision makers at the lower level of the organisation who are concerned mainly with planning and controlling routine operations and who require finer discernment of the sensed information about an entity. The lesser degree of usefulness in the NON USE group is illustrated by the comment about the planning of product mix on a short time basis

where the supervisor had to compensate for the inaccuracy of the information from the measurement system, or by the need of another manager to try and balance good jobs with bad jobs, using different and more accurate information. A typical reason for such a situation was illustrated in the comment "The ratio of labour to sales is a crude measure - not consistent". The increase in usefulness as far as control is concerned was brought out by the decision makers in the USE group who had had previous experience in a company not using work measurement and who maintained the decision makers now were able to exercise more control than they did previously because of the greater accuracy.

Taking into account the quantitative data from the various components of accuracy and the comments from decision makers, it is fair to conclude that the USE group decision makers perceive there to be a distinctively higher level of accuracy in their management accounting information related to direct labour activity than do NON USE group decision makers.

#### 8.2.2 Comparability

It could be reasoned that accuracy, against some bench mark or conceived and established standard was not so useful as the property of comparability, and that as long as the measurement system enabled the decision maker to compare one entity with another, he would be able to make decisions. If this was so, and he could make decisions, the information could be regarded as being useful even though it was not accurate. Comments from some NON USE decision makers confirmed this in that they were satisfied with the information even though it was not accurate. It would not be surprising therefore, to find

that the views about the comparability property of usefulness were closer to each other in the USE & NON USE groups than those about accuracy. In fact, the analyses of the data shows the opposite, a wider divergence in the views on comparability. The USE group viewed this property to be much more in evidence than the NON USE group did, both with job comparability and time period comparability.

The extent to which comparison, matching like with like, can be made between entities such as jobs and operations or time periods, has been clarified in section 2.7 as an important indicator of usefulness with different decision models. At the level of decision makers dealt with in this research, Horngren's (1) classification of "Attention direction questions" is one where comparability is useful in that it helps to focus managerial effort where it is most needed - where the imperfections, inefficiencies and opportunities lie. In this context, the data presented on comparability is reinforced by the comments of USE group decision makers that they know which work centres to concentrate decisions on or that they can gain an idea from the management accounting information where problems are located or further still that it gives a comparison of action taken.

Hornngrens (2) classification of "Scorecard Questions", 'am I doing well or badly", or, 'how do I evaluate performance', are developed or answered by comparison over time periods. The lesser usefulness of information in this area in a NON USE company, is illustrated by the decision maker who felt unfairly criticised about costs because the

(1) Charles T. Horngren 'Cost Accounting and Managerial Emphasis' Prentice Hall International Inc. London 1972 Page 3.4

(2) Ibid

comparison had not been like with like, due to the crudeness of the measuring device, or why for the same inadequate comparison, another decision maker had to use his own information in order to make the results appear consistent.

The narrower divergence of the views of the two groups on accuracy as against comparability may have arisen not only from the greater usefulness of comparability as illustrated above, but also from the quantitative nature of the survey questions which measured accuracy and a difficulty of perceiving quantitative proportions by the NON USE group. Such a difficulty might have been present by virtue of them rarely having the need to give such an analysis their attention in contrast to the USE group, some of whom, as evident in the data on the work measurement moderator variables, are associated with reviews of values carried out by work measurement practitioners on the grounds that they are either too high or too low an estimate. The comparability measures on the other hand were seeking views on experiences which were a direct part of the managerial decision making responsibilities of the NON USE group and therefore any limitations of the information were perhaps more easily recognised by them than were levels of properties of accuracy.

The quantitative data on comparability and its subsequent analysis leads to the conclusion that a significantly higher level of the property of comparability is perceived to be present in management accounting information about direct labour activity by USE group decision makers than by NON USE group decision makers.

### 8.2.3 Objectivity

Turning now to objectivity, reference has already been made to the fact that those USE decision makers who considered that a large percentage of assessed values were over estimated had registered bias favourable to the production department. There is further evidence of the objectivity data being corroborative to the reliability component in that most of these NON USE decision makers who registered "some bias" or more had quite large percentages of assessments which were either an over or under estimate.

A feature of the data on objectivity was that only 2 NON USE and 2 USE decision makers perceived the bias to be unfavourable towards the production department and so there was little cause for most of the decision makers to feel dissatisfied with the accounting information on the grounds of it being biased against him or his section. Of the eleven NON USE and eight USE group decision makers who registered some degree of bias favourable to the production department it was one of the latter who demonstrated the nature of concern about accounting information when it was biased in favour of the production department. The drift in some direct labour activity values, combined with concessions made under pressure from the work force to a policy of loose values through allowances, had lead him towards not having greater confidence in the management accounting information. As discussed in section 2.8 T.A. Lee (3) suggests that users of accounting information will only allow it to influence their behaviour if they have confidence in the objectivity of the process and the processor:

- (3) T.A. Lee "Psychological Aspects of Accounting" in Accounting and Business Research, Summer 1975 Page 225

"The credibility of the information rests largely on the credibility of the information process and the processor"

The comparison of the levels of objectivity irrespective of the direction of bias has shown that there is a significantly less degree of bias and consequently higher degree of objectivity in the USE group of companies. This objectivity and freedom from bias is a property of management accounting information which is an important consideration in "Scorecard questions" or performance evaluation. Its usefulness was indicated in this context by a USE group decision maker with a confidence in the management accounting information which enabled him to use it in appraising and evaluating improved performance of individual operators in his frame assembly section. Again, contribution statements were used in evaluating the improvement of new operatives being trained in a sewing machine section in one case, and with spring makers in another case.

On the other hand, one or two NON USE decision makers had said that experience enabled them to evaluate performance and that they could tell instinctively whether there was slack performance or when people were not pulling their weight. Are these judgements discerning enough however? What is not known is the effectiveness of these decisions - nor for that matter of the effectiveness of those in the USE group. What this research sought to examine however, was not effectiveness of decisions but decision makers perceptions of usefulness of management accounting information in relation to the USE or NON USE of work measurement.

As far as the objectivity property of usefulness is concerned then, the quantitative data and qualitative evidence summate to the conclusion that a significantly higher level of objectivity is

perceived to be present in direct labour management accounting information by USE group decision makers than is perceived by NON USE group decision makers.

### 8.3 Effects of Moderator Variables on Dependent Variables

A further dimension of analysis of the dependent variable results is now pursued in an intra group examination of any emergent effects of the moderator variables. These moderator variables were incorporated into the research design to check whether any additional indicators or extensions to the USE/NON USE states of work measurement as measured by the independent variables, might have had a systematic effect on the variance in either a positive or negative direction on the dependent variables.

Following the measurement of the moderator variables, it was suggested that they were not consistently strong enough throughout the companies in either group to have an overall positive or negative effect on the group results of perceived usefulness of management accounting information arising from the independent variables but that their stronger presence in individual companies might affect the results from that company.

Examination of the intra group results of the NON USE group shows that the one company which tended to have the highest scores from one index of usefulness to another, had no moderator variable characteristics which might have been responsible for this.

Three of the remaining four companies had one or more reinforcing moderator variable characteristics such as wrist watch timing and allowances, an assessor of direct labour activity who had been,

at an earlier stage, trained and experienced in the use of work measurement or they were using work measurement in another limited sector of the factory. However, in one of these companies the usefulness scores as a whole were lower and in the other two they were at the norm. It appears then, that there was almost no effect by the moderator variables on the dependent variables, not only on the group as a whole but also on individual companies of the group.

Examination of the intra group results of the USE group shows that there was no consistent relationship within the group between levels of sophistication and overall levels of usefulness, taking into account the scores on the various indices. There was one instance of commonality between lack of sophistication in work measurement systems and a lower perception of usefulness in that one of the business units with lower than norm scores across the various indices was a company with no checks on rating skill, no appreciation courses for supervisors and managers and some lack of independent status of the technique. However, the other lower scoring company exhibited a normal cross section of the refinements of work measurement and the two companies which generated higher scores did not exhibit higher levels of refinement of the technique.

A common feature (measured by the independent variable) of the two lower scoring companies was that the work measurement techniques had been introduced more than five years ago, however, the two higher scoring companies were not consistent, one had been using the technique for seven years, the other for just over two years. It is feasible to suggest that the decision makers in this latter business unit had a higher perception of usefulness than others in

the group because they were able to make a comparison with the information which had been available from the earlier coarser method of assessment which was still within their memory. Information based on the longer established work measurement schemes may be less valid due to "pollution of standards by addition of percentages" or to a drift in measured values arising from subtle changes in method which are not registered, in contrast to re-measured changes of method such as from a screwed joint to one stapled and glued. Again, even without changes in method the long term effect of the learning curve as demonstrated by the work of Bevis (3) may cause erosion of values and thus lower the accuracy of information.

#### 8.4 Conclusions

In reaching an overall conclusion about the usefulness of management accounting information, some examination of the intra group results of the dependent variable measures is warranted. The differences in the perceptions of the individual properties of usefulness between the groups have been examined and it is appropriate to consider whether these differences have arisen from any inconsistencies of results within the groups themselves and if so, why these differences might have arisen.

In this context, if the median scores of the various indices within the NON USE group are examined, they are seen to be reasonably consistent ranging from 7 to 9. (the variation index has been inverted in each group). Accuracy displays the lower indices in both groups and this, together with the extremes in Table 5, have already

- (3) F.W. Bevis An Exploratory Study of Industrial Learning with Special Reference to Work Study Standards Unpublished MSc Thesis U.W.I.S.T. 1970

been discussed. This consistency or relative narrowness of range suggests that the wider difference between perceptions of comparability by the two groups than their perceptions of accuracy and of objectivity arises from a moderate incremental change in opposite directions rather than a sharp fall in the NON USE index. Had the latter situation prevailed, such an inconsistency might have brought into question the validity of the measuring devices.

Drawing together the perceptions of the individual properties of usefulness of management accounting information as measured both quantitatively and qualitatively by the dependent variables, accuracy, comparability and objectivity, and taking account of the moderator variables, it is concluded at this stage of analysis that there is sufficient and considerable weight of evidence to support the hypothesis that:

"There is a positive relationship between the use of work measurement and the perceived usefulness of management accounting information by decision makers".

## 8.5 Summary

This chapter has dealt with the survey results of the decision makers perceptions of the usefulness of management accounting information. The main framework of the presentation and analysis was based on the three information properties of accuracy, comparability and objectivity, together with the overall usefulness of management accounting information. The quantitative levels of perception of usefulness of information in all these three properties were found to be significantly higher in the USE group than in the NON USE group and these differences were well supported by the verbal comments of decision makers on the overall usefulness of accounting information.

One of the points of interest arising from the subsequent discussion was that within these results some USE group decision makers perceived the majority of the values of direct labour activity to be an overestimate, though not by a large margin, of the in practice value. These perceptions were in line with the views of the same respondents that in terms of objectivity there was a directional vector of bias in the data in favour of production departments.

One possible explanation of this could be that entities of direct labour activity might have changed from their original measured values rather than that these values lacked accuracy from the start. Another feature was the wider divergence in the views of the two groups of the comparability property. This occurred because of a higher intra USE group perception of comparability relative to their more modest view of the accuracy property.

Taking into account the quantitative measures of accuracy, comparability and objectivity, the trend of which was well supported by the verbal comments from decision makers, it is fair to conclude that a higher level of usefulness is perceived to be present in direct labour management accounting information by USE group decision makers than by NON USE group decision makers. A further dimension of analysis of the dependent variable was pursued in an intra group examination of the effects of the moderator variables, those variables indicating greater or less sophistication in the USE or NON USE state of the groups. No marked effects on the dependent variable emerged from this analysis. This together with a check on any inconsistencies of results within the groups themselves indicated,

at this stage of the analysis, sufficient weight of evidence to support the hypothesis that:

"There is a positive relationship between the use of work measurement and the perceived usefulness of management accounting information by decision makers".

CHAPTER IXTHE ENVIRONMENT OF THE MANAGEMENT ACCOUNTING INFORMATION9.0 Effects of Extraneous Variables

The hypothesis has been substantiated within the main pivot of research design - the relationship between the experimental or manipulative independent and moderator variables, USE/NON USE of work measurement; and the dependent variable perceived usefulness of management accounting information by decision makers. However, final validation of the hypothesis depends on an examination of the conditions and environment in which these perceptions were measured to ascertain whether elements in such conditions were stronger in one group or the other so that they either counteracted or reinforced the effect of the manipulative experimental variables. The need to incorporate some such form of variance control into the research design was brought out in section 5.4 and this need was met by the development of the various extraneous variables in sections 5.8 to 5.10, and 6.7.

This final validation of the hypothesis proceeds by analysing and discussing the survey data which measured the extraneous variables of Management Accounting Function, Budget Standards, Participation and Superior Subordinate Relationships. Each of these is examined in turn to assess the strength of their presence in the environment and then the measures of the variable Perceived Usefulness of Information on Raw Materials Issue are examined in an attempt to assess the actual effects the relative presence of these variables on the dependent variable.

### 9.1 Management Accounting Function

The Management Accounting Function was the first of these extraneous variables identified in section 6.7.1 and this variable was seen to be compounded of timeliness, relevance and understandability. These properties have a common origin in the management accounting function itself and are influenced by the attitudes within the accounting function rather than the climate of environment surrounding the decision makers use of accounting information. It has been shown in section 6.7.1 that absence of these various properties could produce an adverse reaction on the part of managers or supervisors and lead to a rejection of the information or a lowering of the extent to which information is perceived to be useful.

Decision makers were asked (questions 7-18) to what extent they found the management accounting reports timely for their purpose and the responses were coded from 1 to 10 so that higher scores indicated reports as being "often" or "very often" timely and lower scores indicated reports as being "seldom" or "very rarely" timely. This possible range of scores, the actual range of scores recorded for each group of companies and their respective median scores of timeliness are set out in Table 16.

Again, decision makers when asked about relevance, responded to a ten point scale (questions 7-17) in which high scores were generated when reports were perceived as being "often" or "very often" relevant and lower scores generated for the reports being "seldom" or "very rarely" relevant. The possible range of scores, 1-10, the actual range of scores recorded for each group of companies and the group median scores of relevance are also

set out in Table 16.

The responses to enquiries (question 7-19) about reports being understandable, were logged on a ten point scale in which perceptions of reports being "unclear" and "confusing" were coded with lower scores, and perceptions of reports being "clear" and "understandable" with higher scores. Similarly the two other components of understandability, viz the frequency of discussion of reports with the accountant and the perceived degree of co-operation with the accountancy section were measured with ten point scales (questions 7-20 and 7-21) so that more discussion and co-operation earned higher scores and less discussion and co-operation earned lower scores. The possible range of scores for these three measures combined together under the one heading of understandability, is set out in Table 16 as being 1-30 and the actual range of scores recorded for each group together with their respective median scores are also set out in the table.

The combination of all these factors becomes the variable Management Accounting Function whose measures therefore generated a total possible score range of 5 to 50, lower scores indicating a lower state of the Management Accounting Function in respect of its processing and presentation of accounting information and higher scores indicating a higher state. This possible range, the actual range of scores recorded for each group of companies and their respective median scores of the variable Management Accounting Function are set out in Table 15.

TABLE 15Management Accounting Function Scores of USE and NON USE groups

<u>Size of Group</u>	<u>Possible Range</u>	<u>Actual Range</u>	<u>Median Score</u>
USE Group n1 = 15	5-50	18-44	31
NON USE Group n2 = 11	5-50	26-45	36

Examining first of all the scores for the combined variable, Management Accounting Function, the NON USE group are then seen to have a perception of the overall existence of the management accounting function variable which is at a higher level than that of the USE group although the difference is not statistically significant using the two tailed Man Whitney U Test.

TABLE 16Timeliness, Relevance and Understandability Scores of USE and NON USE groups

<u>Index</u>	<u>Size of Groups</u>	<u>Possible Range</u>	<u>Actual Range</u>	<u>Median Score</u>
TIMELINESS	USE Group n1 = 16	1-10	3-9	7.5
	NON USE Group n2 = 12	1-10	6-10	8
RELEVANCE	USE Group n1 = 16	1-10	3-9	7.5
	NON USE Group n2 = 12	1-10	5-9	7.5
UNDERSTANDABILITY	USE Group n1 = 15	1-30	10-28	19
	NON USE Group n2 = 11	1-30	15-27	20

Examination of the separate data for each of the constituent parts of the management accounting function, which is summarised in Table 16 indicates either marginally higher differences or no difference in the central tendencies of the NON USE group scores compared with the USE group and also a wider range of scores from the USE group. Examination of the low end of this actual range suggest that there were more decision makers in the USE group who individually had adverse perceptions of the internal functioning of the management accounting system than was the case with the NON USE group. The management accounting information about which these responses were made was received monthly by one decision maker in the USE group and by 3 decision makers in the NON USE group - the remainder of the decision makers received the information on a weekly basis.

The data collected from accountants (questions 8-01 to 8-08) concerning timeliness and understandability acted as a check on the views of the decision makers. The views of the accountants tended to confirm the views of the decision makers about the respective states of the management accounting function.

In the cases examined in this research then, it can be said that the higher levels of perceived usefulness of management accounting information by the decision makers in the USE group of companies was not influenced by there being a higher degree of internal functioning of the systems themselves within that group of companies as compared with the USE group of companies.

## 9.2 Budget Standards

It has been shown in section 6.7.3 that where a policy exists of setting budget standards which are too tight, then rejection of the budget information can occur, and on the other hand, budget targets and goals which are too loose cease to be regarded as important or useful and less attention is paid to budgets. If budget standards or targets were either too tight or too loose in either of the groups of companies studied, then these associated attitudes might have influenced in a negative manner the decision makers perception of the usefulness of their management accounting information.

Decision makers were asked to indicate their views of budget standards on a ten point scale (question 7-06) ranging from "too loose" through "just right" to "too high" in order to generate a budget standards index. Budget goals perceived as being at either end of this scale i.e. too loose or too tight, were coded with the lowest score of 1, increasing scores being awarded from each end of the scale to a maximum score of 5 for responses in the middle of the scale indicating budget targets to be just right. Thus low scores on this budget standards index could imply a reduction in perceived importance or even rejection of the budget.

TABLE 17Budget Standards Scores of Decision Makers

<u>Scores on Budget Standards Index</u>	<u>Numbers of Decision Makers</u>	
	<u>USE Group</u>	<u>NON USE Group</u>
5	4	3
4	7	9
3	2	1
2	3	
1		
	Total	Total
	16	13

The numbers of decision makers for each group who scored the various possible scores on the budget standards index are set in Table 17. The median score for each group is 4 thus demonstrating that the central tendency of the scores is the same in both the USE and NON USE groups. Three USE group decision makers thought that standards were either "too loose" or "too tight" with no decision makers in the NON USE group having views on budget standards as extreme as this. The data suggests that decision makers perception of the usefulness of management accounting held in either of the groups as a whole had not been influenced by tighter or more loose budgets in the one group than existed in the other.

### 9.3 Participation

Section 6.7.4 demonstrated that dissatisfaction was present if managers and supervisors were not involved in the setting of standards, and further still that participation and being able to influence the setting of standards was associated with a lesser

evidence of withdrawal and aggression towards budgets and standards. Using ten point scale measures decision makers were asked about the influence of others, the frequency and weighting of their own contribution, and their overall participation in the setting of standards (questions 7-02 & 7-05). An example of the way in which the responses were coded is that lower scores were awarded to responses indicating "hardly any weight" of the decision makers opinion influencing the standards through to high scores for "a great deal of weight" of his opinion being taken into account.

The responses from the four questions were combined to give an overall index of participation with higher scores indicating higher degrees of participation. The possible range, the actual range and the median scores of the two groups on this index are set out in Table 18:

TABLE 18

Participation Index - Scores of USE and NON USE Groups

<u>Size of Groups</u>	<u>Possible Range of Scores</u>	<u>Actual Range of Scores</u>	<u>Median Scores</u>
USE Group n2 = 15	4-40	8-37	29
NON USE Group n1 = 12	4-40	14-34	31

The NON USE group had a slightly higher median score on the participation index than the USE group although the difference is not statistically significant. Examination of the full data indicates 4 decision makers from the USE group whose index score was lower than any of the NON USE group. As far as participation was

concerned then, the higher levels of perceived usefulness of information of the decision makers in the USE group was not influenced by the existence of a higher degree of participation within the USE group of companies than existed in the other group.

#### 9.4 Superior Subordinate Relationships

The final feature of the environmental and organisational conditions in which the management accounting system might operate was identified in section 6.7.5 as the relationship between superior and subordinate as manifest within the budget aspect of the accounting information area. It was shown that the way in which use is made of management accounting information by supervisors varies with different leadership patterns. This pattern may be of such a nature that it adversely affects the decision makers view of the information.

##### 9.4.1 Frequency of Personal Communication

In measuring the first component of this relationship, frequency of communication about budget variance and about cost effectiveness, decision makers were asked to indicate the frequency of discussion with their superiors of seven different aspects of production, including budget variance and cost effectiveness. This frequency was recorded on ten point scales coded to generate low scores for "seldom" or "very rarely" and high scores for "often" or "very often". The scores of five other aspects of production were then discarded and those for the two items concerned with accounting information were then combined to give one score as a frequency of communication index. The possible range, the actual range and the median scores of the two groups on this index are shown in Table 19.

TABLE 19

Frequency of Communication Index Scores of  
USE and NON USE Groups

<u>Size of Groups</u>	<u>Possible Range of Scores</u>	<u>Actual Range of Scores</u>	<u>Median Scores</u>
USE Group n2 = 16	2-20	10-20	14.5
NON USE Group n1 = 12	2-20	10-18	14.5

With the scores of both groups showing the same central tendency and almost the same range it can be said that the difference between the attitude towards budget information by decision makers in the two groups has not been influenced by a greater no lesser degree of frequency of budget communication between superiors and subordinates.

#### 9.4.2 Performance Appraisal

The second component of superior subordinate relationships that of the power element, was measured by the response to question 7-09. Decision makers ranked the importance of various factors thought by them to have been taken into account when their performance was being appraised by their superiors. Examination of the data revealed that 31% of decision makers in the USE group and 66% of decision makers in the NON USE group ranked meeting budget targets within the top three of nine possible items that might have been taken into account. In addition to meeting budget targets some of these decision makers also included overall cost effectiveness within the top three rankings. Also there were only 8% of NON USE group decision makers, compared within 44% in the USE Group,

who had neither meeting budget targets nor overall cost effectiveness ranked in the top three of the nine items.

From the analysis developed in section 6.7.5 it can be concluded that a superior subordinate evaluation style involving exclusive high ranking of meeting budget targets, or high ranking of both meeting the budget target and overall cost effectiveness could give rise to more widespread dissatisfaction. Also that lower levels of dissatisfaction could be experienced by subordinates who ranked neither meeting the budget nor concern with overall cost effectiveness among the top three criteria used by their superiors in performance appraisal. The dominance of budget variance in performance appraisal within the NON USE group creates the possibility that the budget, itself a neutral thing, might be blamed and treated as a scapegoat. This may have been manifest in some negative influence on the NON USE groups perception of the dependent variable usefulness of management accounting information. Thus the lower level of perceived usefulness found in the NON USE group of decision makers might not have arisen exclusively from the NON USE of work measurement but may have been contributed to by the power pressure elements in the performance appraisal segment of the leadership style of their superiors.

#### 9.4.3 Frequency of Group Discussion

The third component of superior subordinate relationship was that of frequency and usefulness of group meetings at which operating statements or budgets were discussed. When such group meetings exist and are seen to be useful, then they help to create a more positive attitude towards the management accounting information system. Decision makers who regularly attend group meetings were asked to

indicate on a ten point scale the frequency of budget discussions at their meetings and the frequency of such discussions being helpful to them. The responses were coded to generate low scores for "seldom" or "very rarely" and high scores for "often" or "very often" and the results from the two questions were combined to give a Frequency & Usefulness Index of Group Discussions of Budgets. The possible range, actual range, and median scores of the two groups on this index are set out in Table 20.

The way in which the range of scores of the USE group extended further down the scale indicated that more of these decision makers experienced less occurrence and usefulness of discussion than occurred in NON USE groups. Furthermore, the central tendency of the scores was higher in the NON USE group with a median of 17 compared to 15 in the USE group although this difference is not significant at  $p = .10$  in a two tailed Mann Whitney U test. If anything, the state of this component suggests there may have been a slightly stronger positive influence on the perceived usefulness of management accounting information in the NON USE group than in the USE group, but not significantly so.

TABLE 20

Group Discussion of Budgets - Frequency and Usefulness Index  
Scores of USE and NON USE groups

<u>Size of</u> <u>Group</u>	<u>Possible Range</u> <u>of Scores</u>	<u>Actual Range</u> <u>of Scores</u>	<u>Median Scores</u>
USE Group n2 = 13	2-20	2-20	15
NON USE Group n1 = 9	2-20	12-18	17

### 9.5 Perceived Usefulness of Information on Raw Material Issue

This analysis of the Management Accounting System and Environment has so far identified any differences in the extent to which various extraneous variables were present, between one group and the other. The variable Perceived Usefulness of Information on Raw Materials Issue as outlined in Section 6.7.6 was incorporated into the research design in an attempt to check the effects or influences the relative presence of these extraneous variables was actually having on outputs from the information system. Decision makers recorded their perception of usefulness of information output about raw materials in a similar manner to that of information about direct labour activity. Taking the overall view of the accuracy of the measures of raw material issues used in the management accounting information system, 87.5% of the USE group and 84.6% of the NON USE group thought that as distinct from short measures or generous measures, the information did yield accurate measures of charge or debit of the amount issued. Results of the measures of perceptions of other properties of usefulness are summarised in Table 21. Examination of Table 21 shows that in each of the properties measured, the actual range of scores recorded was identical from group to group or if not was seen to be quite similar. Furthermore, in each of the properties measured, the central tendencies of the USE group and the NON USE group, as indicated by the median were identical.

If accountants had had markedly different inter group views about information relating to raw materials issued it could be an indication that there might be some difference in the basic nature of the data source of the information from one group to another. This then would have brought into question the commonality in the

perceptions of the two groups of decision makers. Data collected from accounts (questions 9.02 to 9.07) however, showed them as having the same inter group commonality and at the same perceived levels as the decision makers. This then confirms that as far as output of the management information system dealing with raw material issues is concerned, there is no difference between decision makers from the two groups in their perception of the usefulness of the output.

TABLE 21

Perceived Usefulness of Information on Raw Materials Scores of  
USE and NON USE Groups

<u>Index</u>	<u>Size of Groups</u>	<u>Possible Range of Scores</u>	<u>Actual Range of Scores</u>	<u>Median Scores</u>
Accuracy of Average of Measures	USE Group n2 = 16	1-10	8-10	9
	NON USE Group n2 = 12	1-10	8-10	9
Comparability (Jobs)	USE Group n2 = 16	1-10	8-10	9
	NON USE Group n1 = 13	1-10	8-10	9
Comparability (Time)	USE Group n2 = 16	1-10	7-10	9
	NON USE Group n1 = 13	1-10	7-10	9
Objectivity	USE Group n2 = 16	1-11	8-11	11
	NON USE Group n1 = 13	1-11	5-11	11

## 9.6 Management Accounting System and Environment - Conclusions

What can be concluded about the overall effect of these various extraneous variables that have just been examined in terms of their possible influence on one or other of the two groups of business units? First of all has there been any influence of a confounding nature where positive results could arise from unwanted variables reinforcing the influence of the experimental variable - resulting in this case in a widening of the difference in perceived levels of usefulness between the groups? There are no instances throughout the component variables of this construct where there is a greater existence of the level of a variable in the USE group which would be likely to heighten the anticipated effect of the experimental variable. However, in one component of the Boss Subordinate Relations variable, that of appraisal of performance, there was a markedly stronger presence in the NON USE group of the dominance of budget variance in performed appraisal. This could have resulted in reinforcing the effect of the experimental variable in that it might have adversely affected the NON USE groups perception of the usefulness of management accounting information and thus widened the hypothesised difference in the perceptions. Considered in perspective however, it is but one part of the whole extensive environment of the accounting system and therefore in terms of the whole potential for confounding, its effect may be expected to be of a minor nature. Considering now extraneous influences of a cancelling nature, there does not appear to be present any variable or component of a sufficient strength, which would give rise to perceptions of lesser usefulness by the USE group or greater usefulness by the NON USE group. In other words, there are no powerful extraneous or unwanted influences

of a cancelling nature which would counteract in a negative way the effects of the designed experimental variable USE/NON USE of work measurement.

Having identified the presence of some small degree of extraneous influence, did it in fact have a confounding influence on the results. The measures used to check this suggest that there was, in the event, no confounding influence. If the inequality of the state of the Management Accounting System Environment has been strong enough to influence that particular output of accounting information concerned with direct labour it might be reasonably supposed that it would influence the perception of another output, that of information on raw material issues. Given an assumed consistency (see section 6.7.6) of basic data source such as linear or cubic measurement, applicable to both groups, the perceptions of usefulness of information on raw materials issue by the groups would be expected to be similar to each other UNLESS the extraneous influence from the Management Accounting System and Environment of one group was stronger to the extent of affecting these perceptions. The perceptions measured were in fact, the same from one group to another and therefore it is argued that extraneous variables have influence neither with perceptions of usefulness of information about raw materials issue nor perceptions of usefulness about information on direct labour activity. It is further concluded then that the differences, as measured, in the dependent variable were directly associated with the manipulation of the designed experimental variable, and that as hypothesised:

"There is a positive relationship between the USE of work measurement and the perceived usefulness of management accounting information by decision makers."

### 9.7 Summary

Final validation of the hypothesis has been carried out in this chapter where the survey data which measured the extraneous variables has been analysed to ascertain whether these were stronger in one or other of the groups to an extent which could have counteracted or reinforced the effect of the manipulative experimental variables. The analysis of measures of the Management Accounting Function, Budgets Standards, Participation and Superior Subordinate Relationships indicated no stronger influences of a cancelling nature in either the USE group nor the NON USE group. As far as any reinforcing effect was concerned it was seen that of all these variables, only one component of the Superior Subordinate Relationships - the use of budget variance in performance appraisal was markedly stronger in one group, the NON USE group. Having identified the presence of some small degree of extraneous influence, the measures of perception of the usefulness of Management Accounting Information on Raw Materials Issues were examined to check whether in the event there had been a confounding influence on the results. The perceptions were in fact the same from one group to the other. They had not been influenced by any slight difference in the strength of the extraneous variables. It was therefore concluded that the differences in perception of the usefulness of accounting information about direct labour were associated with manipulation of the designed experimental variable and that as hypothesised:

"There is a positive relationship between the USE of work measurement and the perceived usefulness of management accounting information by decision makers".

## CHAPTER X

### ACCOUNTANTS PERCEPTION OF ACCOUNTING INFORMATION

10.0 This chapter suggests some benefits in examining the relationship between the USE of work measurement and accountants perception of the usefulness of management accounting information, describes the methodology of the examination, sets out the results of a survey and draws conclusions from an analysis and discussion of these results.

#### 10.1 Basis and Objectives of Analysis

Having established the relationship between the use of work measurement and the perceived usefulness of management accounting information by decision makers within a given industrial context, understanding of the relationship between the two techniques can be enlarged further by examining the perceptions of usefulness held by accountants working within the same context. It may well be that accountants in the respective groups hold different views about the usefulness of information than do decision makers in their groups. Such differences may arise not merely because accountants on the one hand and decision makers on the other are fulfilling different roles, but because there is possibly some degree of introversion in the attitudes of accountants in that their attitudes have largely been moulded by literature and systems experience generated by other accountants.

The delineation of any differences between the perceptions of accountants and decision makers could help accountants to appreciate their own need for more breadth of knowledge of understanding of the business system and the behaviour and attitudes of people

within the system, as part of the staff development for accountants suggested by Simon.(1) Again, they might be helped in viewing the system more clearly from the standpoint of their clients and be aided not merely in their role as systems designers and operators but, as Hofstede (2) suggests, in their necessary role as educators. A recognition of any differences in perception would be a necessary element in such a role.

## 10.2 Methodology

The examination of the perceived usefulness of management accounting information by accountants was based on the hypothesis set out in section 5.7 viz:

"There is a positive relationship between the USE of work measurement and the perceived usefulness of management accounting information by accountants."

The investigation was carried out within the same groups of companies used for testing the first hypothesis and whose composition was generated by the use of the experimental and manipulative independent and moderator variables, Use of Management Accounting Information (sections 6.1 and 7.3), USE of Work Measurement (sections 6.2 and 7.4) and NON USE of Work Measurement (sections 6.4 and 7.5). The independent variable Small Business Unit Profile (sections 6.5 and 7.6) is a description of the business characteristics of the companies in these two groups. Although the state ascertained by the measures of the extraneous variables also remained unchanged,

- (1) Simon, Guetzkow, Kozmetzky, & Tyndall, "Centralisation Versus Decentralisation" as quoted in Hofsted G.H., The Game of Budget Control, Tavistock Publications 1968 p.220
- (2) Hofstede C.H. The Game of Budget Control. Tavistock Publications 1968 P.244

this state of the Management Accounting System and Environment was in each case essentially one surrounding and affecting the decision maker and as such is not relevant in the testing of the second hypothesis.

The measuring instruments used for recording the accountants perception of the Usefulness of Management Accounting Information were the same as used for recording the perception of decision makers. The design and development of these questions was discussed in section 6.6. The results of the application of these measured are now set out under the headings of Accuracy, Comparability, Objectivity and Usefulness, and the ranges and median scores of the indices measuring the components of these various properties are all set down by groups in Table 22.

#### 10.3.1 Accuracy

One measure of the reliability component of accuracy was the differences in the proportions of assessments of direct labour activity regarded as being over estimated or under estimated in relation to the actual direct labour activity required in practice. In the USE group, 5 out of 7 accountants registered zero differences in this proportion whereas in the NON USE group only 2 out of 5 registered zero differences and 2 of the others recorded a difference in proportions of 70% or over.

The measures of the other component of reliability, the proximity of the mean of the scatter of assessed values to the in practice value, revealed that 5 accountants from 7 in the USE group perceived the mean to be either "close" or "very close" to the in practice value as against 1 accountant from 5 in the NON USE group with the same perception.

perception. The median of the proximity scores as shown in Table 22 was 8 for the USE group and 6 for the NON USE group.

In the measurement of perceptions of precision, the other component of accuracy, the responses on the variation index indicated that 2 USE group accountants perceived that there was a "very narrow variation" or close clustering of assessed values round their means whereas no NON USE group accountants thought the values to be so close clustered. As shown in Table 22, the USE group had a median variation score of 3 indicating a higher degree of this component of accuracy than in the NON USE group whose median score was 4.

The combined indicator of the precision and reliability components of accuracy is that proportion of jobs having assessments thought to be neither an over estimate nor an under estimate. From company to company in the USE group the average of the proportions of jobs whose assessment was perceived by accountants to be accurate was 66% whereas the average of the proportions quoted as being accurate by NON USE group accountants was 44%.

### 10.3.2 Comparability

To what extent did accountants find the assessed figures of direct labour in the operating statements to be a reliable guide when comparing job with job or one week or month with another? In comparing one job with another, all accountants in the USE group viewed the figures as being either "very often reliable" or "often reliable" resulting in a range of scores of from 7 to 10. The range of perceptions of the NON USE group accountants was also a narrow one ranging from "sometimes reliable" to "very often reliable" resulting in scores of from 6 to 9. The median scores on job comparability were 9 for the USE group and 8 for the NON USE group.

In comparing one time period with another, the perceptions of the accountants in each group had a similar narrow range as when comparing jobs and the resulting score range was 7 to 9 in the USE group and 6 to 9 in the NON USE group. The median scores when comparing one week or month were the same for each group at a level of 8, again as indicated in Table 22.

### 10.3.3 Objectivity

How did the accountants in the two groups perceive the means of assessing direct labour activity in terms of being free from bias. There was only one accountant, and he was from the USE group, who thought that the means of assessment was completely impartial. Table 22 shows that the views of the USE group accountants were more widely dispersed, with a range of scores from 5 to 11, than the NON USE group whose score range was quite narrow at 6-8. The median score was higher at 8 for the USE group than the 7 for the NON USE group.

When asked whether the bias they had registered was favourable or unfavourable towards the production department, five accountants from the USE group and four from the NON USE group thought the bias was favourable to the production department.

TABLE 22

Indices of Usefulness Scores  
of Accountants as USE groups and NON USE groups

Index	Size of Groups	Possible Range of Scores	Actual Range of Scores	Median Scores
Proximity	USE Group n2 = 7	1-10	4-9	8
	NON USE Group n1 = 5	1-10	6-9	6
Variation	USE Group n2 = 7	1-10	1-7	3
	NON USE Group n1 = 5	1-10	3-9	4
Job Comparability	USE Group n2 = 7	1-10	7-10	9
	NON USE Group n1 = 5	1-10	6-9	8
Time Comparability	USE Group n2 = 7	1-10	7-9	8
	NON USE Group n1 = 5	1-10	6-9	8
Objectivity	USE Group n2 = 7	1-11	5-11	8
	NON USE Group n1 = 5	1-11	6-8	7

#### 10.3.4 Usefulness

Overall comments by accountants in the USE group on the usefulness of the information on anticipated direct labour requirements tended to endorse, sometimes enthusiastically, the usefulness of the information. There were comments to the effect that managers found it helpful, that trends in costs could be followed, and furthermore, they were dependent on it:

"It is essential - without it we couldn't operate standard costing and budgetary control."

OR "Our managers depend on it for cost control."

In terms of data sources one accountant commented:

"Work measurement is probably my most important basis of data".

Referring to the work measurement practitioners, another accountant commented:

"Without their information projects (accounting) would be difficult - it is absolutely essential to the need to provide information for management".

None of the accountants in the USE group thought that any different means of assessing direct labour requirements would provide more useful information but one or two of them expressed the view that it was necessary to update the data by using the same means, work measurement, to re-measure the whole factory at some time. One accountant felt that some of the assessments should be broken down into smaller tasks to give more detail but also suggested that to extend the information into greater detail might over-burden managers and supervisors.

Of the accounts in the NON USE group, two thought the information was useful for their company purposes on the lines of:

"I think our information is useful and up to date."

and they did not think any different means of assessing direct labour would provide more useful information. Two accountants expressed dissatisfaction by saying that the information:

"Tended to be global and not sophisticated enough in being broken down to units"

OR with the information, managers and supervisors were:

"Not able to make decisions with any degree of satisfaction."

How to utilize its qualified usefulness was illustrated by one accountant who commented:

"Some form of guide is useful no matter how far out it is. If it is consistently out, it is useful. We can compare one week with another due to the consistency of errors."

As far as a different means of assessment was concerned, he then went on to say that he thought more accurate information was required by the utilization of a proper timing system throughout the departments. There was a second specific comment about wishing to measure each item in detail but the accountant in this instance wondered whether managers would have the time to use the information. Finally, one accountant, whilst not thinking that any different means of assessment would provide more useful information, thought that customers requirements should be set out in a more detailed operations breakdown in order to generate more useful assessed times.

#### 10.4 Dependent Variables - Discussion and Conclusions

Considering first of all the property of accuracy, where the indicators of the reliability and precision come together as a combined measure of accuracy, the USE group of accountants clearly perceived a higher proportion, 66% of jobs being accurate, than did the NON USE group with 44% in the same category. As far as reliability was concerned, a large majority of USE group accountants compared with just under half of the NON USE group, registered perceptions resulting in zero differences between over and under estimates of direct labour activity. The proximity component also showed the USE group as viewing the assessments to be closer to the in practice value than did the NON USE group. The precision element of accuracy was, to a certain extent, as indicated in Table 22 by the lower scores in the variation index, stronger in the USE group.

NON USE accountants logged lower perceptions of job comparability but had identical median scores of time comparability indicating closer views, than their perceptions of accuracy, to those of the USE group. Again although USE group accountants had overall a perception of greater objectivity, it was not a marked difference; their range contained some lower scores and the score of the NON USE group emerged from a narrower range of perceptions fairly well up on the scale of responses.

On the whole, the overall verbal comments by accountants in the USE group were much more enthusiastic towards the usefulness of information about direct labour activity than were those of the NON USE group. The latter's verbal comments were on the whole neutral or negative which was in contrast to their quite high scores on their responses to the various scales of usefulness.

How might these various results and differences, which were narrower than with decision makers, be explained? One interpretation could be that a conservative, cautious, or less than frank approach was taken by the NON USE accountants when registering their perceptions on the various structured scaled questions and they were less cautious in conversational response to open-ended questions. From the beginning, it might have been expected that all accountants would genuinely perceive their own information systems to be of considerable use to their organisations and that this honest belief is what has been measured. However, the researcher sensed during the survey, that there was an element of caution being exercised by NON USE group accountants in their responses - the questions may not have been fully effective in measuring what they set out to measure. They may have been inclined to measure what the accountant

thought his chief executives possibly would wish him to record - that of a favourable or praiseworthy view of the system.

By comparing these results with those in Section 7.6 and 7.7, it is possible to highlight the differences in the perceptions of the usefulness of management accounting information which it was suggested in Section 5.7 might exist between decision makers on the one hand and accountants on the other. Comparing the scores of USE group decision makers with USE group accountants, the latter in the main, yielded medians which were one ordinal position ahead of the former.

However, when the same comparison is made with the NON USE group, there are three out of five indices where the accountants medians are 2 or more ordinal positions higher than the medians of the decision makers.

Thus whereas the USE group accountants took a slightly more approving view of their direct labour accounting information than decision makers in their group, the view of NON USE group accountants was decidedly more approving than their decision makers. It was suggested at the beginning of this chapter that the views and conclusions reached by accountants may have been conditioned by their roles and by the nature of their educational and experiential inputs. In this research then, it appears that the perceptions of both sets of accountants of the usefulness of management accounting information may have been conditioned by these factors but more so with the NON USE group than the USE group. A factor in the NON USE group may have been some lack of validity in the measuring device.

Accountants in the small business environment might do well to bear in mind these differences between their perceptions and those of

their decision makers when they are designing and operating information systems for their decision making clients and when they are attempting to educate these clients into effective implementation of control systems. Such awareness is, of course, pertinent to a consideration of whether or not to move from a system based say on sales ratio to one based on work measurement.

Although not so clearly established as is the case with decision makers both from a standpoint of the limited numbers of accountants surveyed and from the lesser inter-group difference than was the case with the decision makers, there is overall a fair degree of evidence to support the hypothesis that:

"There is a positive relationship between the USE of work measurement and the perceived usefulness of management accounting information by accountants."

#### 10.5 Summary

This chapter, having first suggested why delineation of any differences between perceptions of accountants and decision makers could be useful, went on to explain that the investigation into these perceptions was carried out in the same groups of small business units used for the decision makers. The same systems environment prevailed and the same instruments were used to measure the perceived usefulness of information. The results derived from the quantitative measures as a whole indicated a higher but not markedly higher level of usefulness perceived to be present in direct labour management accounting information by USE group accountants than by NON USE accountants. However, the qualitative comments by USE group accountants about usefulness and satisfaction with the present system were much more enthusiastic than those of the NON USE group.

Comparison of the perceptions of accountants with those of decision makers has shown that within the same sample group of small business units USE group accountants took a slightly more approving view of accounting information than did decision makers in their group. On the other hand and taking into account some reservations about the validity of the measuring instrument, in that responses from the NON USE group may have been influenced by their bosses, it seemed that NON USE group accountants took a distinctly more approving view of the information than did their decision makers. It was suggested that these differences between accountants and decision makers in their perception of usefulness of information might help accountants to view accounting systems more clearly from the standpoint of their decision making clients and aid them in their role as designers and operators of management control information systems.

Bearing in mind the numbers of accountants involved and the analysis of both the quantitative and qualitative data it was considered that overall there was a fair degree of evidence to support the thesis that:

"There is a positive relationship between the USE of work measurement and perceived usefulness of management accounting information by accountants."

CHAPTER XISUMMARY AND CONCLUSIONS

11.0 This final chapter summarises the research thesis as it progresses from the origins and objectives of the work through the examination of the generalised theory to the formulation of hypotheses, proceeds with the preparation of a research design and sampling strategy, on via an analysis of the field data to test the hypotheses and arrive at conclusions. The analysis of and findings from certain information gathered to achieve this end but which has additional and supplementary value are set out in Appendix B together with implications from the whole project for various interested parties.

11.1 Origins and Objectives

This thesis has first of all traced the origins of the author's management education and consultancy experience in the small business field and to the stimulus of the comments by the Bolton Report (1) on the use of management techniques by small businesses. A combination of awareness of systems theory and practical experience of both large and small management systems suggested an interdisciplinary approach to the work in terms of studying the relationship between some of these management techniques.

Practical experience had suggested some interesting relationships between two of these techniques, work measurement and management accounting and a brief review of theoretical generalisations about them indicated enough evidence to suggest that an examination

(1) Bolton J.E. Report of the Committee of Inquiry on Small Firms - London H.M.S.O. 1971

of this relationship would be worthwhile. The assumptions clarified for such an examination included the expectation that small businesses were a fertile and accessible area for research and that they were making more use of management accounting than they were of other management techniques. From this review and the stated assumptions the research objective was refined into one of analysing the level of work measurement used in small businesses in relation to its influence on the effective use of management accounting. In order to guide the research programme a preliminary hypothesis was formed which linked beneficial outputs from management accounting with inputs from work measurement.

The relationship of other research work was discussed and this work was seen to be placed in the field of interdisciplinary studies within industrial organisations.

### 11.2 Management Accounting and Work Measurement

Management Accounting was defined and its objectives delineated in the region of providing assistance to decision makers in such areas as performance evaluation, and problem identification and solving through such means as budgetary control and standard costing. The separate activities of a management accounting system were then set out together with those properties thought to be beneficial to decision makers. The particular accounting activity of "measurement" was seen to have useful properties of accuracy, comparability and objectivity and these were analysed in depth and links between these and certain elements of work measurement were brought into focus. The examination of other management accounting activities such as "transmission" or "response", thought to be less directly linked with work measurement was deferred

until later. The application of the techniques of management accounting and its properties to the field of small businesses was then examined and found to be relevant to the area.

Having looked at one technique, the substantive body of theoretical knowledge of work measurement was examined to some depth in order to assess those parts of work measurement which seemed to link with the useful properties of management accounting information. A review of work measurement practice as found by various investigators was also compiled to check on these linking characteristics and to look for others.

The first characteristic examined was the way in which the technique of work measurement divided work tasks into specific and small elements and required systematic recording of these. This characteristic was seen to contribute towards the accounting properties of accuracy and comparability. Time study with its component of rating was seen to link with the accuracy property. This contribution was seen to be positive irrespective of whether the B.S.I. scale or any other rating scale was used, and despite the various criticisms of the method. Relaxation allowances as a part of time study were seen to make some qualified contributions to comparability and objectivity. As well as contributing to accuracy, predetermined motion time systems were seen to reinforce comparability and objectivity.

The reports of various investigators about the extent to which work study practitioners had actually undergone training created an expectation that these procedures and techniques of work measurement shown to contribute to accuracy and comparability would be found in

practice. The degree of industrial experience before training and of subsequent work measurement experience were seen as increasing the capability and credibility of the practitioner as an information processor thus supporting the objectivity property. Also the acquisition through training, of knowledge of rules and procedures was seen as lessening the chance of personal bias and of reinforcing objectivity. The review of work measurement in practice also indicated that this technique, like management accounting, was applicable to and used by small businesses and therefore the interrelationship between the two techniques could be examined within the small business field.

### 11.3 Research Design and Testing

General concepts of research design and testing were considered and from these the nature of the research being undertaken was classified as a combination of case study and correlational research. Testing, measurement, variance control, validity and reliability, as necessary features of research design were taken into account together with the earlier theoretical analyses in formulating the following hypotheses:

1. "There is a positive relationship between the use of Work Measurement and the perceived usefulness of Management Accounting Information by decision makers."
2. "There is a positive relationship between the use of Work Measurement and the perceived usefulness of Management Accounting Information by accountants."

A number of constructs and variables were then proposed and set in a suitable framework for the testing of these hypotheses. This framework was the foundation of a sampling strategy in which two sample groups of businesses would be generated, a "Use" group who

were operating work measurement and a "Non Use" group who were not using the technique. Both groups would be using management accounting and would be alike in other respects such as the technology operated or the type of production used. The strategy involved the selection of the Furniture and Timber Industry in the North of England as an industrial segment which offered this similarity between businesses and also reasonable opportunity for access for field investigation.

Each construct in the research framework was then developed into one or more variables which are now summarised. The "Use of Management Accounting Information" was the first criteria for the selection of businesses from the random sample thrown up by responses from the Furniture and Timber Industry. In order to fulfill its purpose of generating a group of small businesses who were using management accounting it included such dimensions as length of experience by accountants and the nature, timing, and destination of accounting information.

The "Use of Work Measurement" and the "None Use of Work Measurement" were the classifications or variables used to separate out from the overall group of small businesses the users of work measurement (the "Use" group) and those not using work measurement (the "Non Use" group). These classifications included such main features as the techniques used for assessing direct labour activity and the training and experience of practitioners, and subsidiary features such as the training of decision makers or wrist watch timing of jobs.

A third main classification measure was developed as the "Small Business Profile". This measure was used not to generate or

separate the groups of small businesses but to assess whether the two separate groups were alike in such areas as products made, technology of operations, and type or mode of production.

The other main area of the research framework was the variable "Perceived Usefulness of Management Accounting Information." It was the change in the extent to which information was viewed or perceived by decision makers (in this case supervisors or factory managers) and accountants as being useful, which was forecast as depending on whether or not work measurement was in use. The properties of usefulness to be measured in the research were those of accuracy, comparability and objectivity of accounting information.

The final but none the less important feature of the research framework was to take into account certain characteristics of the immediate environment of the accounting information system, such as poor transmission of information, which might be more evident in one group than the other. If this were so, the views of the group about the usefulness of accounting information might be conditioned by this adverse characteristic rather than by whether or not they were using work measurement. Under the heading of "Management Accounting Systems and Environment" a number of possible areas of influence were identified as worth measuring such as the "Internal Function of the Accounting Systems" including timing and clarity of reports; "Participation" by decision makers in setting of budget targets, and the nature of "Superior Subordinate Relationships". Finally some measures were designed to check whether any of these characteristics if found to be present to a predominate extent in one group had actually had any effect on the views or perceptions of the group. In order to do this, measures entitled "Usefulness of

Accounting Information on Raw Materials Issues" were to be used to assess the views of the groups on what was a parallel output from the management accounting system viz, data about the raw materials issued and charged to departments.

#### 11.4 Generation of Use and Non Use Groups by the Survey

All the firms on the lists supplied by the Furniture and Timber Industry Training Board of firms in the Northern Area as having between 100-499 employees were asked to co-operate in the collection of field data by allowing their supervisors or factory managers and other staff to be interviewed. The Northern Area covered Humberside, the whole of Yorkshire, the North East and Cumbria. The overall response from this geographical area of firms willing to co-operate was 46% and this sample, comprising 28 business units, was assessed as being a reasonable spectrum of the types of companies comprising the total population of 60 firms.

Three of these 28 firms were used as part of the testing procedure for the interview schedule and the application of the three measures; Use of Management Accounting Information, Use and None Use of Work Measurement, generated a USE group of 7 companies and a NON USE group of 5 companies. All 12 companies were users of management accounting information. The remaining 13 were excluded because they failed to match one or other of these three measures. The most noticeable effect of the measures was the exclusion of 8 companies from further study because they were not using management accounting techniques. As in the main they were also not using work measurement the effect of this was to reduce the size of the NON USE group relative to the USE group.

### 11.5 Decision Makers Perception of Accounting Information

The data collected in the field survey to measure the dependent variable perceived usefulness of management accounting information by decision makers, was then analysed. The main framework of this analysis and presentation of the results was based on the three information properties of accuracy, comparability and objectivity, and on the overall usefulness of management accounting information. The quantitative levels of perception of usefulness of information in all these three properties were found to be significantly higher in the USE group than in the NON-USE group and these differences were well supported by the verbal comments of decision makers on the overall usefulness of accounting information.

One of the points of interest arising from the subsequent discussion was that within these results, several USE group decision makers perceived the majority of the values of the direct labour activity to be a marginal over-estimate of the in-practice value. These perceptions were in line with the views of the same respondents, that in terms of objectivity, there was a noticeable bias in the accounting information in favour of production departments. One possible explanation of this could be that some direct labour tasks might have changed from their original measured values rather than that these values lacked accuracy from the start. Another feature was the wider divergence in the views of the two groups of the comparability property. This occurred because of both higher scores in the USE group and lower scores in the NON USE group relative to their views on accuracy.

Taking into account the quantitative measures of accuracy, comparability and objectivity, the trend of which was well supported

by verbal comments from decision makers, it is fair to conclude that a higher level of usefulness of management accounting information is perceived to be present in direct labour management accounting information by USE group decision makers than by NON USE group decision makers. A further dimension of analysis was pursued in an examination within each group of two factors. First of all was there any noticeably greater or lesser degree of sophistication in the USE or NON USE state of work measurement of each group? Secondly were there any inconsistencies within each group itself in the results of the measures of perception of accounting information. No marked effects emerged from these examinations which indicated at this stage of analysis sufficient weight of evidence to support the hypothesis that:-

"There is a positive relationship between the use of work measurement and the perceived usefulness of management accounting information by decision makers."

Up to this stage of the project, the hypothesis has been substantiated within the main pivot of the research design - the relationship between the key variables USE/NON-USE of work measurement and the dependent variable perceived usefulness of management accounting information. However, final validation of the hypothesis rested on an examination of the environment in which the dependent variable had been measured to ascertain whether certain factors were stronger in one set of group environments than in the other to the extent that they either counteracted or reinforced the effect of the key variables:

The research design had evolved the variables of Management Accounting Function, Budget Standards, Participation, and Superior Subordinate Relationships, as particular factors to be measured in the environment. Analysis of the survey data which measured

these these variables indicated no stronger influence of a cancelling nature in either the USE group or the NON USE group. As far as any reinforcing influence was concerned it was seen that of all these variables only one component, the use of budget variance in performance appraisal, of one variable - Superior Subordinate Relationships, was markedly stronger. This was in the NON-USE group.

Having identified the presence of some minimal degree of additional influence, the measures of perception of the Usefulness of Management Accounting Information on Raw Materials Issues, were examined as a check whether, in the event, there had been a confounding influence on the results. The perceptions about this raw materials information were, in fact, the same from one group to another. They did not seem to have been influenced by any slight difference in the strength of the additional variables. It was therefore concluded that the differences in perception of the usefulness of accounting information about direct labour activity were associated with the change in the USE/NON-USE variable as hypothesised.

#### 11.6 Accountants Perception of Accounting Information

Having established the relationship between the use of work measurement and the perceived usefulness of management accounting information by decision makers within a given industrial context, understanding of the relationships between the two techniques was enlarged further by examining the perceptions that accountants working in the same groups of business units had about the same accounting information. The same systems environment prevailed and the same instruments were used to measure the perceived usefulness of information.

The results derived from the quantitative measures as a whole, indicated a higher but not significantly higher, level of usefulness perceived to be present in direct labour management accounting information by USE group accountants than by NON-USE group accountants. The qualitative comments of the USE group accountants however, suggested a perception of a considerably higher level of usefulness than was indicated by NON-USE comments. It was maintained then, that on the whole, there was a fair degree of evidence to support the hypothesis that:

"There is a positive relationship between the USE of Work Measurement and the perceived usefulness of Management Accounting Information by accountants".

Comparison with the perceptions of decision makers has shown that within the same samples on small business units, USE group accountants, took a slightly more approving view of the accounting information than decision makers in their group. On the other hand, the view of NON-USE group accountants was markedly more approving than that of their decision makers. Discounting some reservations about the validity of the measuring instrument, in that responses from the NON-USE group might have been influenced by their bosses, it seemed that accountants from the NON-USE group took a much more favourable view of accounting information than did their decision makers, but that this was less so with USE group accountants. It is suggested that these found differences in the perceptions of usefulness of information, might help accountants to view accounting systems more clearly from the standpoint of their decision making clients and aid them in their role as designers and operators of management control information systems.

## 11.7 Conclusions

11.7.1 The testing of the hypotheses was carried out in two groups of small business units who had a common profile of business and industrial characteristics and whose management accounting information systems operated within similar environments.

11.7.2 In companies with 100-499 employees making furniture and timber products in the North of England, supervisors and managers found management accounting information to be of greater use to them in their decision making when it was based on work measurement.

11.7.3 In companies with 100-499 employees making furniture and timber products in the North of England, accountants considered the management accounting information to be more useful when it was based on work measurement.

APPENDIX ATHE QUESTIONNAIREA.1 Measurement Quality and Pretesting

In developing operational definitions and their component questions to measure the several variables the measurement quality objectives of validity and reliability have been aimed at throughout the process. The difficulty of ensuring validity and reliability been realised throughout the process. The difficulty of ensuring validity particularly of attitude type questions was recognised, nevertheless attempts were made to construct and design schedules which were measuring what they were supposed to be measuring. Questions were tested out on experienced people in known situations in an attempt to establish comparative criteria. On certain factual questions, more than one informant i.e. the chief executive and the work study practitioner or the accountant and decision maker were to be asked about the same event. Again, where possible as with participation and superior subordinate relationship, advantage was taken of using previously well established sets of questions.

The reliability objective, that of avoiding variations in responses due to inconsistencies in the measurement process, was aimed at in varying ways. Pre-testing was carried out with several subjects in order to show up faults in wording or sequence. Some internal checks were built in by a form of elaboration, e.g. when measuring accuracy of management accounting information, the respondent was asked a qualitative question about the presence of certain entities and then a quantitative question about their relative proportions. Again, in the case of work measurement experience, an overall time

could be compared with summations of individually quoted times. Where possible, single answer questions were avoided and scales of responses or sets of questions were used.

Pretesting was carried out in several companies with various types of respondent e.g. accountants, estimators, production supervisors and managers. The number of questions and their wording was refined over two or three weeks by starting the pretesting with establishments and people known well enough to the researcher to be able to discuss the responses in comparison with a known situation. These were not necessarily in small businesses as some of the people with expert knowledge of work measurement were to be found in large companies. Thus validity criteria were aimed at first and then aspects of reliability were strengthened as pretesting was extended into small business units in the furniture and timber industry.

#### A.2 Planned Application of the Questionnaire

The first stage of the plan to carry out the survey, following on the development, pretesting and final design of the questionnaire, was to send a one page letter to the Training Officer of each company on the list provided by the Furniture and Timber Industry Training Board seeking the participation of the company and indicating that the letter would be followed by a telephone contact. These two positive but different modes of approach, one following the other, were thought to offer the best chance of measuring participative responses from companies in the form of an interview at the convenience of the respondent. At this stage, the intention was to collect data from those companies on the list who responded in order to generate the two dichotomous groups. The companies who were found to be using a management accounting

system would be placed in the USE of work measurement group, the NON USE group, or would be excluded from either classification according to the readings of the profile drawn from the independent variable measures.

The first interview would be conducted with the owner, managing director or chief executive using the independent variable questions IV 1-01 to 1-19 followed by IV 1-20 to 1-25 and or IV 1-26 to 1-30 as appropriate. The intended application of USER only and the NON USER only questions does not imply a prejudgement of which classification a company would fall into but rather the choice of a particularly designed instrument to check a perceived situation; it might be that both instruments would have to be applied to one company in order to produce a comprehensive measurement.

It was considered a matter of some importance that the chief executive would be interviewed first so that through the opportunity for him to clarify further his understanding of the whole project there was confirmation of the company's approval of the subsequent investigation. This interview would be followed by interviews with the accountant to confirm the use of management accounting. The work study practitioner or those persons responsible for assessing the direct labour activity required in manufacturing the product would then be interviewed. These latter might be estimators, production managers or even the accountant himself. The primary interview with the accountant would use the independent variable questions on the schedule referenced IV 2-01 to 2-11. The independent and moderator variable questions IV 3-01 to 3-07 and MV 4-01 to 4-07 would be used with the work measurement practitioner and questions MV 5-01 to 5-09 with the person(s) responsible for assessing the direct labour activity in a NON USE company.

The interviews were expected to last from 30 to 45 minutes each and it was not anticipated that there would be much difficulty in achieving an effective use of these sets of factual questions, and in controlling and minimising variations in the repeat administration of these particular schedules in many companies. This would contribute to validity and reliability of the measures.

Following the classification of all the responding small business units into the USE or NON USE groups or their rejection from further investigation because their profiles as recorded did not match either group, the next stage of the survey plan was to arrange interviews with production managers and supervisors as decision makers and with accountants in order to measure the dependent, extraneous & check or control variables. The number of decision makers interviewed would depend upon the actual size of the company and the level to which management accounting information was made available but within a given company care would be taken to ensure as far as possible that all production managers and supervisors who were in receipt of information were interviewed. This was intended not simply to increase the sample size of respondents but to reduce the possibility of bias, and it was considered necessary to be aware of any attempt by small business units to exclude individual decision makers from the interview measures.

Inadequate questionnaire construction is not the only cause of poor validity, it is important to bear in mind that errors can arise in the application of the questionnaire. One way of helping to ensure that the measuring device is measuring what it is supposed to be measuring is to have a proper and effective procedure for the application of the questionnaire schedule. The researcher

would need to take care to build up a suitable rapport with the respondent and maintain this throughout the interview which for this stage was expected to last between forty-five and sixty minutes, and at the same time, take every care to avoid the possibility of bias resulting from his approach to the respondent.

Hopwood's (1) reflections about the person being interviewed are appropriate in this context. What is the respondent's relationship with the research situation and the interviewer; why should he use his time up in being interviewed; what is in it for him? He would need assurance that the interview and the information yielded would become anonymous in the research report and would not be divulged to his peers or supervisors. He would however, have been asked by his supervisor to be available for interview and the knowledge that his superior may discuss the interview with him after the researcher has departed might colour his responses. That the research was to be conducted in small companies might affect the responses in this way in that close proximity of different levels of the organisation might reduce the feeling of personal independence of the respondent. He might unwittingly respond in a manner in which he thinks the boss would want him to. On the other hand, answers might be biased through the respondent using the interview to rationalise a particular incident or personal conflict with say the accountant, or work study officer.

As well as creating a relaxed and confidential atmosphere, then, the interviewer would need to encourage an impartial approach to the questions by the respondent otherwise the readings of the measuring instrument would be indicators of criteria such as

(1) A.G. Hopwood. *An Accounting System & Managerial Behaviour* Saxon House, Lexington 1973 Pages 49, 50.

As well as creating a relaxed and confidential atmosphere then, the interviewer would need to encourage an impartial approach to the questions by the respondent, otherwise the readings of the measuring instrument would be indicators of criteria such as what the accountant felt the M.D. would want him to say and not indicators of the criteria that the instrument should be measuring. The timing and place of the interviews was considered of importance in planning for effective use of the questionnaire, the desired interview atmosphere would not necessarily be developed if the respondent had a stressful work task immediately pending or if his departure home was being delayed, nor if the interview was constantly interrupted by the immediacy of production problems. Accordingly, it was intended that a time for the interview would be sought at a particular time slot during the day when the manager or supervisor was free of the peak loading of tasks and at a place which encouraged a rigorous approach to the questions by the respondent. A balance would also have to be sought between the advantage that conducting an interview away from the shop floor would have in avoiding interference and interruption of the interview with undesirable breaks, and that of a person being unsettled or on guard as a result of being removed from his working environment. The respondents preference would be sought as a means of achieving this balance, some respondents might feel less strained and overawed in their immediate work environment than in an interview room in the front office.

Having given thought to validity, the planning of the application of the interview schedule needed to cater for reliability as the degree of reliability or consistency sets a limit to the degree of validity possible. The survey should be planned in such a way that repeated administration of the questions would give very similar readings when confronted with the same state, wherever that state might be in the

spectrum, in different companies and at different times. To cater for this need was not seen to be as difficult as it might be in larger surveys where the problem of variation in the actual application of the questionnaire is associated with several different interviewers as in this case the uniformity of application remained the responsibility of the one researcher. This uniformity could be improved by ensuring adequate time for interviews, particularly those which completed the interview for a particular company. Such interviews might otherwise be squeezed in to avoid a revisit. Special care would seem to be desirable in such later interviews that any impression gained by the researcher of the state of perception of earlier respondents in a given company was not conveyed to later respondents. Finally it was thought to be desirable to arrange interviews in a given company within as short a time span as possible to lessen the possibility of earlier respondents influencing through conversation the responses of later respondents.

Some of these needs to improve validity and reliability during the conduct of the survey were seen as being in conflict with each other and yet it was necessary to have them continually in mind when planning and carrying out the survey.

A3 INTERVIEW SCHEDULE AND QUESTIONNAIRE

Independent Variable Questions to Owner/ Managing Director/Chief Executive - all companies	I.V. 1-01 to 1-19
- ditto - USERS of work measurement only	I.V. 1-20 to 1-25
- ditto - NON USERS of work measurement only	I.V. 1-26 to 1-30
Independent variable questions to Accountants - all companies	I.V. 2-01 to 2-11
Independent variable questions to Work Measurement Practitioners - USERS of Work Measurement only	I.V. 3-01 to 3-07
Moderator variable Questions to Work Measurement Practitioners - USERS of Work Measurement only	M.V. 4-01 to 4-07
Moderator variable Questions to Estimators/ Production Staff/Accountants - NON USERS of Work Measurement only	M.V. 5-01 to 5-09
Dependent variable questions to Production Managers/Supervisors/Accountants - all companies	D.V. 6-01 to 6-17
Extraneous variable questions to Production Managers/Supervisors - all companies	E.V. 7-01 to 7-21
Extraneous variable questions to accountants - all companies	E.V. 8-01 to 8-08
Control variable questions to Production Managers/Supervisors/Accountants - all companies	C.V. 9-01 to 9-07

INTERVIEW SCHEDULEINDEPENDENT VARIABLE QUESTIONS - OWNER/MANAGING DIRECTOR/CHIEF EXECUTIVEI.V.

- 1-01 Would you please tell me something about the history and background of this company? (Record answer on separate sheet).
- 1-02 What is the total number of employees here and how many are employed in the factory?
- 1-03 What is the annual turnover of the company here?
- 1-04 How does it fit in with parent or associated companies?
- 1-05 How big are these companies in terms of:
- a) Total turnover?
  - b) Total number of employees?
- 1-06 Would you please describe briefly the organisation of this company? (Record answer on separate sheet)
- 1-07 Do you have an organisation chart I could look at please?
- 1-08 What are the main products of this factory?
- 1-09 What main markets do these products go to?
- 1-10 In the production side of the business could you please describe the types of production carried out? For example whether it is small quantities of purpose made products, or medium size batches of products of a particular range?

1-11 Approximately what proportion does each type represent of your total production?

Jobbing    Small batch    Medium batch    Large batch  
Continuous?

1-12 Do you employ an accountant here?

1-13 What is his job title and what work does he carry out?

1-14 What functions are any group accountancy section responsible for here?

1-15 Do you have a system of budgeting?

1-16 For what periods is the budget prepared e.g. monthly or annually?

1-17 Could you please show me what operating statements are prepared showing actual results against budget and indicate which are the direct labour figures (List statements prepared)

1-18 To what level or to which people are these systems made available and how often?

1-19 Would you please explain briefly the payment scheme in operation for the production operatives? (This question may have to be directed to the Works Manager or Production Director).

I.V.1-20 to 1-25 are for USERS of Work Measurement only

- 1-20 To what extent do you make use of any work measurement techniques such as Time Study or Predetermined Motion Time Systems?
- 1-21 How long has the company been using these techniques to this extent?
- 1-22 Is work measurement carried out by someone here at this factory?
- 1-23 If so, by whom and how is it carried out?
- 1-24 Is time study or some other work measurement technique used as a means of assessing the anticipated or budgeted amount of direct labour activity as set out in operating or cost statements?

OR

- 1-25 If NO what means is used and by whom? (Use space below for either question)

I.V.1-26 to 1-30 are for NON USERS of Work Measurement only

1-26 By what means or yardstick does the company assess direct labour activity e.g. by numbers produced, estimated times, sales value or historical records?

1-27 Are these the means used for assessing the anticipated or budgeted amount of direct labour activity as set out in operating or cost statements?

OR

1-28 If NO what means is used? (Use space below for either question)

1-29 Who assesses direct labour activity?

1-30 Who assesses anticipated or budgeted amount of direct labour activity as set out in operating or cost statements?

INDEPENDENT VARIABLE QUESTIONS:-ACCOUNTANTI.V.

- 2-01 May I enquire what functions and tasks you cover here?
- 2-02 Would you please describe briefly the organisation of your section and how it relates to the rest of the organisation?
- 2-03 Are operating statements prepared here showing actual costs of labour against budgeted or anticipated costs and if so may I see what form they take?
- 2-04 Is there any form of standard costing in use here and if so could you briefly explain its method of operation?
- 2-05 If NO to both 03 and 04  
Are operating statements prepared showing actual output of direct labour against budgeted or anticipated outputs and what form do these take?
- 2-06 Could you please explain the methods or means used for assessing the anticipated or budgeted amount of direct labour activity as set out in the operating or cost statement?
- 2-07 For what periods are these various statements prepared?
- 2-08 To what level or to which people are these statements made available and how often?

- 2-09 For how long has the company used these means of control?
- 2-10 How long have you yourself worked with systems of cost control?
- 2-10 Would you please tell me whether you have any form of qualification?
- 2-11 Approximately what percentage do labour and material costs represent of:      Sales Revenue      or      Sales revenue less Profit
- Labour cost
- Material cost

INDEPENDENT VARIABLE QUESTIONS:WORK MEASUREMENT PRACTITIONERI.V.

- 3-01 Could you please tell me what work measurement techniques are used here? Interviewer check list:-  
Time Study      P.M.T.S.      Activity Sampling      Standard Data
- 3-02 Can you please indicate roughly what percentage of direct labour output is assessed by these techniques? (If not sure, this question to be asked of senior production executive)
- 3-03 How long has the company been using work measurement to this extent?
- 3-04 Have you attended any form of training or courses in work measurement and if so whereabouts?
- 3-05 Was this full time or part time and for how long was the work measurement content?
- 3-06 For how long have you practised work measurement:-  
a) before training?  
b) after training?  
c) in this company?
- 3-07 What industrial experience, other than doing work measurement, have you had and for how long?

MODERATOR VARIABLE QUESTIONS:WORK MEASUREMENT PRACTITIONERM.V.

- 4-01 Have you attended any sessions or seminars to check out your rating skill, within the last two years?
- 4-02 If so, whereabouts and how was the check carried out?
- 4-03 Could you tell me please whether any reviews of performance of operatives are carried out or have been carried out?
- 4-04 What jobs if any have been remeasured during the last two years? If so, why?
- 4-05 May I look at some descriptions of jobs or methods associated with measured values? (Interviewer to check for acceptable standard).
- 4-06 Could you tell me where you fit into the organisation of this company?
- 4-07 Have production supervisors and managers attended appreciation courses on work measurement, and if so what form did they take? (This may need to be put to production staff themselves).

MODERATOR VARIABLE QUESTIONS:ESTIMATORS/PRODUCTION STAFF/  
ACCOUNTANTS IN:NON USERS OF WORK MEASUREMENT  
COMPANIES (See I.V. 1-29/30)M.V.

- 5-01 What means or yardstick is used to assess the direct labour activity required for jobs or for production e.g. by numbers of items, estimated times, sales value, or historical record?
- 5-02 Are these the means used for assessing the anticipated or budgeted amount of direct labour activity as set out in operating or cost statements. If so for which statements?
- 5-03 May I look at any lists of times or quantities that are used for assessing the direct labour activity of jobs or production? (List various types on separate sheet and against each record responses to 5-04.)
- 5-04 For each list or data source:-
- Are these based on timed observations?
  - If so how was the timing carried out?
  - Do they include any allowances for rest or contingency delays?
  - Are any such allowances added at any later stage?
- 5-05 Can you indicate please approximately what percentage of direct labour output is measured by these various yardsticks?
- 5-06 Have you had any experience of work measurement and if so what sort of experience?

5-07 Have you had any form of training either in work measurement or in estimating techniques?

5-08 What was the nature and duration of any such training?

5-09 Would you please outline briefly the nature and extent of your industrial experience?

DEPENDENT VARIABLE QUESTIONS:PRODUCTION MANAGERS/PRODUCTION  
SUPERVISORS/ACCOUNTANTS

6-01 Would you please tell me something about the job you do here and the products and processes with which you are concerned?

(Excludes accountant)

6-02 Could you please explain briefly the payment system in operation here for the production operatives?

D.V.

6-03 Would you please tell me what reports of actual results or operating statements in relation to estimates or budgets do you see and how often? (Excludes accountant)

6-04 Could you please explain the methods or means used here for assessing the anticipated amount of direct labour activity required, as set out in the operating statements(s)?  
(For accountant this is recapitulation)

6-05 Do you find these means of assessing anticipated direct labour activity required result in:-

Please tick either Yes or No for each statement.

	Yes	No
An over-estimate of the activity required in practice for any of the jobs or operations?		

	Yes	No
An under-estimate of the activity required in practice for any of the jobs or operations?		

	Yes	No
An accurate estimate of the activity required in practice for any of the jobs or operations?		

6-06 Approximately what proportion of jobs or operations have:-

Proportion

An over-estimate of the activity required in practice?

An under-estimate of the activity required in practice?

An accurate estimate of the activity required in practice?

If you are unable to indicate a proportion please write Dont Know.

6-07 From job to job how wide is the variation in the values from under-estimate to over-estimate? Please tick one space.

Very wide variation	Wide variation	Medium variation	Narrow variation	Very narrow variation

OR

6-08 From job to job how wide a variation is there in the extent to which the jobs are over-estimated? Please tick one space.

Very wide variation	Wide variation	Medium variation	Narrow variation	Very narrow variation

OR

6-09 From job to job how wide a variation is there in the extent to which the jobs are under-estimated? Please tick one space.

Very wide variation	Wide variation	Medium variation	Narrow variation	Very narrow variation

6-10 Why do you think these variations occur?



6-14 The means of assessing direct labour activity may be viewed as either being completely impartial or as having some degree of bias. Would you please consider the means of assessing direct labour activity requirements here and indicate the degree of bias, if any, you think this has. please tick one space.

Completely impartial	Very little bias	Little Bias	Some Bias	Considerable Bias	A great deal of bias
Alternatively			Dont Know		

6-15 If biased - do you think the means of assessing direct labour activity requirements is:

biased favourably towards the production department?

Please tick one

biased unfavourably towards the production department?

D.V.

6-16 Have you any overall comment on how useful the information about anticipated direct labour requirements contained in operating statements, is to managers or supervisors here?  
(To be asked also of M.D. at conclusion of study.)

6-17 Do you think that any different means of assessing the anticipated direct labour requirements would provide more useful information for managers or supervisors here?  
(To be asked also of M.D. at conclusion of study.)

EXTRANEOUS VARIABLE QUESTIONSPRODUCTION MANAGERS/SUPERVISORSE.V.

7-01 Are you able to say how direct labour output targets which are incorporated in the budget or operating statement are set here? (Record on separate sheet)

7-02 By and large, to what extent do you participate in the setting of direct labour output targets. Please tick one space.

To a very great extent	To a considerable extent	To some extent	To a little extent	To hardly any extent

7-03 How often is your opinion asked concerning the setting of direct labour targets? Please tick one space.

Very rarely	Seldom	Sometimes	Often	Very Often

7-04 How much weight does your opinion carry in the setting of direct labour output targets? Please tick one space.

A great deal of weight	Considerable weight	Some weight	Little weight	Hardly any weight

7-05 To what extent does the influence of others affect the setting of direct labour output targets? Please tick one space,

alternatively

Dont Know

A great extent	To a considerable extent	Some extent	Little extent	To hardly any extent

7-06 Do you think direct labour output targets are tight or loose in this company? Please tick one space.

Too loose	Fairly loose	Just right	Tight	Too tight

7-07 Why do you think this to be the case? (Record on separate sheet)

7-08 In any production unit certain aspects of production tend to be the subject of discussion between superiors and subordinates more frequently than others.

Would you please assess how frequently your superiors discuss the following topics with you. Please tick one space for each topic.

	Very rarely	Seldom	Some-times	Often	Very often
Meeting quality standards					
Overall cost effectiveness					
Material utilisation					
Meeting production schedules					
Meeting budget targets					
Technical problems					
Any other topics					

7-09 In most companies when the performance of managers or supervisors is being assessed or appraised, certain items are of more importance than others. Which of the items printed on these cards are of greatest importance when performance is being assessed or appraised here, and which are of least importance? Would you please arrange all these cards in order of importance you think each item has. (Record ranking)

Product Quality ( )	Get on well with others ( )	Overall results in relation to costs ( )
How much effort I put into my job ( )	Meeting production schedules ( )	Meeting Budget targets ( )
Getting things done by people below me ( )	Technical or trade knowledge ( )	Other items ( )

7-10 Have you any particular reasons for arranging them in that order?

E.V.

7-11 I would now like to enquire about any meetings you may or may not attend here. Could you please tell me whether any meetings are held between yourself, your fellow managers or supervisors, and your superior(s)?

Please tick one

Not at all

Sometimes

Regularly

7-12 How frequently are results as declared in operating statements or budgets discussed at these meetings?

Very rarely	Seldom	Sometimes	Often	Very Often

7-13 Do you find these discussions on operating or budget results helpful?

Very rarely	Seldom	Sometimes	Often	Very Often

7-14 Why do you find them so?

7-15 What reports of actual results in relation to anticipated or budget figures do you see or receive?

7-16 How frequently do you see or receive these?

7-17 How relevant to your activity do you find these reports?

Very rarely relevant	Seldom relevant	Sometimes relevant	Often relevant	Very often relevant

7-18 Do you find these reports timely for your purpose?

Very rarely	Seldom	Sometimes	Often	Very often

7-19 In general are these reports clear and understandable?

Very unclear & confusing	Unclear and confusing	Partly understandable/ Confusing	Clear and understandable	Very clear and understandable

7-20 How frequently do you discuss with the accountant or his staff actual results in relation to anticipated or budgeted levels?

Very rarely	Seldom	Sometimes	Often	Very often

7-21 To what extent do you think does co-operation exist between the accountancy section and the production department?

A great extent	Considerable extent	Some Extent	Little Extent	Hardly any extent

EXTRANEOUS VARIABLE QUESTIONS:-ACCOUNTANTS

8-01 Do you attend meetings with managers at which budget results are discussed?

Please tick

Not at all

Occasionally

Regularly

8-02 Do supervisors attend these meetings?

Not at all

Occasionally

Regularly

8-03 Do you think these discussions on budget results are helpful to managers and or supervisors?

Very rarely      Seldom      Sometimes      Often      Very often

--	--	--	--	--

E.V.

8-04 Why do you think this is so?

8-05 I would now like you to consider the timing of the various reports to the production function.

Are there any reports which are difficult to issue in time to be useful aids to management control?

8-06 Which are these reports and what is the nature of the difficulty with these?

E.V.

8-07 Would you please indicate how frequently managers and supervisors from the production function discuss budget or operating statement figures and variances with you or your staff. Please tick one space.

	Very rarely	Seldom	Sometimes	Often	Very Often
Managers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supervisors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8-08 To what extent do you think does co-operation exist between the production function and the accountancy section? Please tick one space.

A great extent	Considerable extent	Some extent	Little extent	Hardly any extent
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CONTROL VARIABLE QUESTIONS:-

PRODUCTION MANAGERS/SUPERVISORS/  
ACCOUNTANTS

C.V.

9-01 Could you please explain how the issue of raw material used for jobs is measured and recorded. (Interviewer to record on separate sheet)

9-02 On the whole do these measures of raw material issued give:

Please tick one

Short measure i.e. charge or debit more than actually issued

Generous measure i.e. charge or debit less than actually issued

Accurate measure i.e. charge or debit exactly the amount issued

Dont Know

9-03 Please indicate how close you think the average of these measures of raw material is to that actually issued?

Please tick one space.

Very close	Close	Not far out	Some way out	A long way out

C.V.

9-04 In comparing the material issued for one job with that issued for another do you find these measures of raw material reliable? Please tick one space.

Very rarely reliable      Seldom reliable      Sometimes reliable      Often reliable      Very Often reliable



9-05 In comparing the material issued from one time period to another do you find the measures of raw material reliable? Please tick one space.

Very rarely reliable      Seldom reliable      Sometimes reliable      Often reliable      Very Often reliable



9-06 Means of measurement are seen as being completely free of bias or as having some degree of bias. Would you please consider the means of measuring and recording the issue of raw material. Please indicate the degree of bias if any you think these means have. Please tick one space.

Free of bias      Very Little Bias      Little Bias      Some Bias      Considerable Bias      A great deal of Bias



Alternatively      Dont Know

9-07 If biased - is the source

Please tick one

Biased favourably towards the  
Production Department

Biased unfavourably towards  
the Production Department

APPENDIX BREVIEW OF SUPPLEMENTARY DATA AND IMPLICATIONS  
OF THE RESEARCH FOR INTERESTED PARTIES

B.0. The opportunity is taken in this appendix to highlight some thoughts arising from reviewing or scanning the whole of the research project. A certain amount of the data gathered in the exploration of the whole research area became supplementary in that it contained information which could be examined in contexts additional to the actual testing of the hypotheses. This data is now analysed for possible useful findings and to pose some speculative questions. Implications are shown from both the main conclusions and from these further findings for such interested parties as small businessmen, other researchers, management teachers and writers, and industry training boards.

B.1 Some Practical Consequences for Small Businesses

Consideration is now given to possible practical consequences or outcomes of the research which might help small businesses. In discussing Initial Aims and Hypotheses in Section 1.5 it was suggested that a practical outcome of the research activity might be some revelation of the contribution that could be made by work measurement to management control in small businesses. Such a revelation might be of assistance to small businesses when faced with the decision of whether or not, and to what extent, the business should invest in work measurement as a technique resource.

The research clearly shows that there is a theoretical foundation for the belief that benefits accrue to a management accounting control system if the information base concerned with direct labour is derived from work measurement. Also the results of the field survey

clearly show that managers and supervisors in the sample of businesses used in the research found management accounting information to be of more use to them in their decision making when it was based on work measurement.

As they stand these findings may very well assist small businesses in the furniture and timber industry to decide to change to work measurement based data from what ever alternative means they are currently using. What of small businesses in other industries however? Are they able to gain any help from the research by using the results in the resolution of their decision? In the development of the sampling strategy reported in Section 5.9 it was reasoned that the possibility of applying the results in any small business might be lessened if a sample had been taken which attempted to be representative of different industries and technologies. Such a small business might feel that as far as it was concerned, the results were confounded and influenced by several different technologies and processes to an extent which rendered it unable to transpose and marshall the findings in relation to its own particular activities.

It was decided then that results would be more valid from a more restricted field - a sample from one particular industrial segment of the small business field. It was further argued that because of the relative consistency of production and technology in one industry, a more accurate comparison could be made between the processes in a given business and those in such a single industry rather than with a matrix of processes from several industries.

For any business to consider how relevant the findings are to its own activities, it needs to compare its own profile with the joint profile of the two comparable groups studied as set out in detail in section 7.6. As far as technology of manufacture is concerned, this might be summarised as cutting raw material in panel or linear shape to size, machining or shaping it to a detailed form, often incorporating a mechanical coating, and then assembling it ready for despatch. Upholstered furniture had a parallel main component activity in that fabric was cut and sewn into detailed form before being incorporated into the final assembly operation.

Although there were some instances of jobbing production, the prevailing mode was batch production. According to whether this resulted in conversion to a product via a few or many operations, the ratio of labour to material cost was of the order of 1:8 or of 1:3. The production mode and cost ratio are both profile characteristics which might be helpful in considering applicability of the results as might size of the small business units in the sample. Although there were three business units employing between 200 and 400 people in total, most of the businesses employed between 100 and 200 persons and turnover ranged from £1M to £4M.

A small business has also the opportunity to compare itself from the perspective of market environment with the businesses in the sample although such a comparison may be of lesser importance than say mode of production or technology when deciding whether or not to use work measurement. The profile revealed a range of different markets but in general there were more companies selling to consumer markets, some of which appeared to be keenly competitive, than to

industrial or institutional customers.

If it were to decide in principle to make use of work measurement the small business then faces the problem of deciding to what level or extent it should invest in the technique. The methodology of constructing a sampling strategy involving two separate groups was a feature of research design aimed mainly at effective hypothesis testing. However one of the resultant variables, Use of Work Measurement, and the observations collected in its application in the survey, are also helpful at this stage in that they enable the following recommendations to be offered as guide lines in deciding what level of work measurement to aim at.

The work measurement practitioner should be recruited from people who have had 2 or more years of industrial experience or apprenticeship prior to training and followed by 2 to 3 years practising work measurement. It seems desirable that both these forms of experience should have taken place within the same or similar type of industry to that of the small business concerned. The course of training should have been carried out within a college (public sector or industrial) or at a consultants residential work study school and the course should have included a minimum of three weeks full time, or its part-time equivalent, specialised study of work measurement. Investment at this level in a practitioner would probably require a period of two years application before full benefits were likely to accrue to the management accounting system. If instead of recruiting an already experienced work measurement practitioner, the business was to recruit an internal candidate with no previous experience of work measurement, then this period is likely to be extended beyond two years.

The business should primarily use time study as its particular technique of measurement and with a ratio of one practitioner to 250 total employees or less and with comparable modes of production and technology to firms in this study, it should find that it can extend such measurement to 80% or more of its direct labour activity. A small business would be advised to bear in mind that such measures, unlike the dimensions of a factory building or its machinery, do not maintain their accuracy indefinitely and that as pointed out in section 11.4, it will be desirable at some stage to remeasure the activity.

For those businesses of 100 employees upwards, not already using management accounting and who wished to make use of the technique in order to assist their managers and supervisors with the control and decision making process, some advice can be offered based on the results of applying the independent variable Use of Management Accounting. To achieve a level of use comparable to that found in this research the business would be advised to employ on a full time basis a person whose sole responsibility would be for management accounting or who would divide the majority of his time between management accounting and financial accounting. In the latter case he would need a minimum of one full time assistant working exclusively on management accounting. Such an accountant need not necessarily have a formal qualification but he would need to have had many years of experience. It is suggested that a minimum of 5 years experience of cost control systems would be necessary, some of which could have been as a junior and be the equivalent of the industrial experience or apprenticeship of the work measurement practitioner.

The business could expect a management accounting system to be developed to include detailed statements of anticipated or budgeted

costs and which generated figures of actual costs in relation to those budgets. This information could be of one form or another and expressed as production variance reports, output/budget statements, labour/materials operating costs, factory performance statements, or other such titles. The information could be provided monthly or weekly as desired to managers or supervisors to assist them to control their parts of the business. It should be borne in mind that a period of two years usage or more would be required in order to have comparable levels of application and usefulness as found in businesses in this study.

## B.2 Management Techniques in Small Firms

Both in sections 2.9 and 4.7 it was shown that other researchers and investigators had found the techniques of management accounting and work measurement to be used in practice by small firms to a sufficient extent to justify embarking on this research into the relationships between them. How then does the utilisation of these techniques found by this study compare with that found by earlier workers?

Of the 24 small business units between the 100 to 499 employee size range which were surveyed, 67% were found to be using the technique of management accounting, a much higher proportion than the 40% of similar size firms found by Swann (1) to be using budgetary control. The proportion making full use of work measurement was 33% with 16% which could be classified as partial users of work measurement, and approximately 50% making no use of the technique.

To fall within the classification of Use of Work Measurement in this study, several stringent criteria had to be met and it is

probable that all the so called partial users would have been classified by Bevis and Collier (2) and by Swann (3) as users of the technique of work study as neither of their classifications took into account such criteria as training or length of experience. If, for the purposes of comparison with the other surveys, the above assumption is made, the proportion of users of work measurement in this study could be expressed as approximately 49%. This compares with calculated proportions of 28% of firms between 201 and 500 employees in the 1963-65 Welsh survey by Bevis and Collier(4) and of 55% of firms in the 100 to 499 employee range in the 1970/71 Yorkshire survey by Swann (5). These calculated proportions result from applying a factor of .94 derived by Bevis and Collier as the proportion of users of work study who were found to be using work measurement.

In the light of these comparisons, it is worth recalling the belief quoted in section 1.1 that the general level of management in small firms is consistently low within most of the functional areas of management. It would seem that in the areas of management accounting and work measurement, around 50% of the firms in this survey could claim to be exonerated from such criticism. It can be said then, that a low level of management practice in these functional areas does not appear to prevail consistently throughout the segment of the furniture and timber industry studied. There is however, still

- (1) K. Swann. Management Attitudes and Techniques in the Small Company. Unpublished thesis University of Bradford 1971
- (2) F.W. Bevis and P.I. Collier An Industrial Survey of Work Study in Wales 1963-1965. An unpublished paper Welsh College of Advanced Technology
- (3) K. Swann Op cit
- (4) Bevis and Collier Op cit
- (5) K. Swann Op cit

a considerable proportion of small firms or business units not making use of these two techniques, a situation comparable to that found by previous researchers in their more general surveys.

An a priori view stated by the researcher in section 1.5 was that small firms were less inclined to use management accounting supported by work measurement and were more inclined to use management accounting without such an input. Was this view substantiated by the subsequent investigation?

Of the 24 small business units surveyed, 16 small firms (67%) were found to be using the technique of management accounting. Of this 16, 7 firms were classed as users of work measurement and 5 as non users. So there were, in fact, fewer firms using management accounting alone than using it supported by work measurement. The remaining 4 firms have, for purposes of broad comparison, been classified as partial users of work measurement, they are certainly not non users. If these are taken into account, then there were 11 out of 16 management accounting firms making full or partial use of work measurement.

It seems therefore, that the a priori view is not born out by this investigation into part of the furniture and timber industry. Here there is a tendency for most of those firms which were using management accounting to have it supported by the use of work measurement as well.

The various findings above coupled with the main conclusions about usefulness of management accounting information have implications for other researchers in the field. They might usefully pursue an

enquiry into why there is not a much greater proportion of small firms making use of management accounting and why such use is not universally supported by work measurement. For industry training boards who may wish to encourage the use of management techniques in general in small firms these findings provide some indication of the potential for increasing the use of management accounting and work measurement.

### B.3 Some Comparative Views of Work Measurement Criteria

Section 7.4 reported on how the small business units met the criteria of the independent variable USE of work measurement and it is worth while comparing these results with the views and conclusions of others.

The fact that only one company made use of predetermined motion time studies, and limited use at that, is of interest in that it contributes to Whitmore's (6) view that British Industry in general has been slow to accept this particular technique of work measurement. The utilisation of time study is also in line with general practice in that the extensive use of time study by these small firms is very comparable to the state of usage found by various researchers as reported in section 4.1. However, with only three companies using activity sampling and to a minor extent, use of this technique was seen to be of a lesser order than reported by the same researchers. As this might indicate some lack of awareness of the extent and nature of production delays these furniture and timber companies could probably benefit from making more use of activity sampling within their factories.

(6) D.A. Whitmore. Work Study & Related Management Services  
Heinman London Page 116

The training and experience of work measurement practitioners as appraised by the independent variable Use of Work Measurement was also reported in section 7.4. Training had exclusively been carried out in various external institutions offering specialised courses and this had been preceded in the main by two or more years of previous industrial experience or apprenticeship. This was followed by considerable experience in the practice of work measurement. Of the 11 firms who initially appeared to be users of work measurement only one was using a work measurement practitioner with less than two years experience of the technique and all of the practitioners in the 7 firms classified as users had 3 years or more of experience. These figures are of a higher order than the 70% of practitioners with 2 or more years of work study experience as reported in the broader study of Bevis and Collier (7). It can be said then, following the monitoring of this training and experience, that within this sector of the furniture and timber industry, training and experience in the technique is at no lesser level than in industry at large.

There are two speculative questions in the area of training and experience, which arises from the earlier review of the state of the art and from these empirical observations. The first concerns the comparison made in section 4.5 of the education of American and U.K. practitioners of work study. American practitioners had to a greater extent obtained a nominally higher level of academic attainment with over 35% of them possessing a degree, than was the case in a U.K. study where less than 20% possessed an H.N.C. or H.N.D. The question could be posed as to whether this difference in academic background results in any lesser effectiveness of the use of the technique of work measurement in the U.K. compared with the U.S.A. This question has a particular relevance in view of the contemporary generalised (7) Bevis & Collier op cit

comment and interest in the need to attract more graduates into the U.K. manufacturing industry.

The second question concerns a tendency observed during this study for the experience of practitioners, both before and after training, to have been acquired within their own furniture and timber industry. Furthermore, the only two instances reported to the researcher where there had been a failure in the introduction of work measurement at some time or other, were attributed to the measurement being carried out by practitioners with little or no experience of the industry. If as a generalisation a view is taken that the nature of work measurement is such that once learned by a person the technique can be applied by him in different industries or technologies, then in the light of these observations, such a view might be profitably challenged or tested by researchers.

#### B.4 Levels of Accuracy in Management Accounting and Work Measurement

As pointed out in section 2.6, Leonard Spacek (8) is one writer who comments on a possible over concern with accuracy and precision in management accounting data; also Bubb Hussey and Smith (9) question whether last penny accuracy is required for managerial decision making. Their views taken together with this research add to the concept of different levels of accuracy of accounting data. This research has found higher perceived levels of accuracy in accounting data based on work measurement and a lower level when no use was made of work measurement.

- (8) Leonard Spacek "Can We Define Generally Accepted Accounting Principles" in Readings in Accounting Theory Ed. Paul Garner & Kenneth B. Berg. Houghton Mifflin Coy. Boston 1966
- (9) P.L. Bubb M.K. Hussey & J.E. Smith "Just How Accurate Are Your Figures?" in Management Accounting, September 1973

No attempt was made in this research to follow up these suggestions that levels of accuracy might be higher than necessary, nor was there any casual comment from small businesses to this effect. However, what did emerge from the study was some indication that the level of accuracy might be eroded over a period of time. Two firms had found it necessary to completely re-measure and re-establish standards of the labour content of their accounting data base and there was some comment from others that this might have to be done in the future. These indications suggest that although firms in this study found accounting data based on work measurement to be more useful, there was some realisation on their part that the entities measured were themselves changing over a period of time and required a re-application of the measurement instrument. This in a way, is comparable to the erosion in stock entities which requires a measurement system based on debits and credits to be reinforced by physical measurements from time to time.

This realisation of the drift to an unacceptably lower level of accuracy is commensurate with the proposal by Bevis (10) who called for the frequent re-measurement of repetitive work tasks to compensate for a learning curve effect of much longer duration than is normally taken into account. This erosion of data accuracy is probably tolerated by management until it reaches a certain level at which point re-measurement becomes necessary. It would be useful to both firms who are about to introduce work measurement as well as those already using the technique, if researchers were to investigate the determination of this level.

- (10) F.W. Bevis "An Exploratory Study of Industrial Learning with Special Reference to Work Study Standards" Unpublished MSc Thesis U.W.I.S.T. 1970

### B.5 Outputs from this Interdisciplinary Research

It was stated in section 1.3 that exposure of the researcher to the theoretical framework of the systems concept of management coupled with earlier experience of managing manufacturing systems focussed interest on the way in which techniques, and the disciplines from which they were derived, interrelated. Such research activity was preferred to that of a study of a narrower cross section of one part of the management process. In retrospect, was this choice advisedly made or did this form of research fall short of the researchers expectations?

The choice of an interdisciplinary study in the first place provided the opportunity for an examination of the interface and boundary between two main theoretical areas. Such examination was only possible via a depth analysis of both areas of knowledge involved and so the researcher's knowledge was expanded of both work measurement and management accounting.

Secondly it provided a challenging experience in research design in an area of cross relationship that was not without some degree of complexity in the various types of variable involved and in constructing measures for some of these variables. Arising from this a definition of the concept of the use of work measurement within a company was generated to a degree not yet found in the general theory.

Above all however, by establishing theoretical links between the two functions and by designing and implementing a means of testing hypotheses about the nature of these links, the work has extended the body of knowledge about subsystem interaction and boundary regulation between work measurement and management accounting.

In doing this a number of speculative questions have also been thrown up which might provide a useful starting point for other researchers.

It is just this form of systems approach which Kast and Rosenzweig (11) maintain is a useful means of exploring the unitary whole that is management. It is suggested then, that this type of work has an important parallel role to play in understanding the management process alongside those forms of research reported in section 1.6 which analyse the origin and nature of particular components of either work measurement or management accounting.

#### B.6 Summary of Implications and Supplementary Findings

The implications for businessmen, management writers and others, certain speculative questions, and the findings from analysis of the supplementary data are summarised below.

B.6.1 As they stand the main conclusions of the research may very well assist small businesses in the furniture and timber industry to decide to change to a management accounting information based on work measurement from whatever alternative means they are currently using.

B.6.2 Any small business faced with a decision of whether or not to change to work measurement based data for its management accounting system could be aided in this decision by making use of the combined business profile of the groups of business units in this research to assess the relevance of the conclusions to its own business.

(11) Fremonte E. Kast and James E. Rosenzweig. Organisation and Management, A Systems Approach. McGraw-Hill Inc. New York 1970 Page 20

Should it decide to use work measurement guide lines are available in this research for an appropriate level of work measurement to be adopted.

B.6.3 Although a low level of management practice in the functional areas of management accounting and work measurement does not appear to prevail consistently throughout the segment of industry studied, these techniques are not used comprehensively. This lack of comprehensive use is comparable to that found by other research covering small firms in general. This has implications for other researchers who might fruitfully enquire into why this is so. For industry training boards who may wish to encourage the use of management techniques in general within small firms this might provide some indication of the potential for increasing the use of management accounting and work measurement.

B.6.4 Accountants from both groups and particularly the NON-USE group took a more favourable view of accounting information than did their own decision makers. It is suggested that if accountants in small businesses were aware of these found differences it might encourage them to critically review their own perception of usefulness when designing and operating accounting information systems for their decision making clients.

B.6.5 Within those small business units in the survey using work measurement there was universal use of time study, a utilisation comparable to that found in industry at large but their use of activity sampling was much lower by comparison. This implies that small businesses in the industry segment might lack full awareness of the extent and nature of production stoppages within their factories.

B.6.6 In the context of training and experience, two areas of research would appear to be worth while pursuing. Firstly, an enquiry into desirable levels of academic attainment before potential practitioners embarked on specialised work study training and, secondly, exploration of relationship between effectiveness of work measurement practice and the nature of general industrial experience and work measurement experience of practitioners.

B.6.7 Management accounting information, though found to be more useful when based on work measurement, might possibly suffer erosion over time to unacceptably lower levels of accuracy. Research into the determination of such levels would be helpful to users or potential users of work measurement, meanwhile management at large might profitably check for possible erosion of accuracy in their management accounting information.

B.6.8 By establishing theoretical links between work measurement and management accounting and by designing and implementing a means of testing hypotheses about these links, this research has had extended knowledge and understanding about the interaction of two subsystems and thereby, of the total system of management. This enables management writers and teachers to present a more comprehensive view of these two areas of management.

BIBLIOGRAPHY

- ALLAN, WILLIAM G.: Work Study and Worker Remuneration. Unpublished MSc. Thesis, University of Strathclyde 1970
- AMERICAN ACCOUNTING ASSOCIATION COMMITTEE: "Report of the Committee on Concepts and standards of Internal Planning and Control". The Accounting Review, October 1974 pp 79-96
- AMERICAN ACCOUNTING ASSOCIATION COMMITTEE: "Report of the Committee on Internal Measurement and Reporting". The Accounting Review Supplement, Vol. XLVIII 1973 pp.209 - 241
- ANDERSON AND ADLER: Establishment of a National Scale of Relaxation Allowances in Work Study. Loughborough University of Technology, Loughborough 1968.
- AVERY, MICHAEL: Time Study Incentives and Budgetary Control. Business Publications Ltd, London 1964.
- BAREFIELD, RUSSEL M.: "The Effect of Aggregation on Decision Making Success: A Laboratory Study": Journal of Accounting Research Vol.10 No.2, Autumn 1972, pp.229-242.
- BÉAVER, W.H. and DUKES, R.E.: "Depreciation Methods, Some Analytical Results". Journal of Accounting Research, Vol.12 No.2, Autumn 1974, pp. 205-215.
- BELBIN, R.M.: Compensating Rest Allowances: Some Findings and Implications for Management Arising from Recent Research, Cranfield Note No.54, College of Aeronautics, 1956.
- BERTALANFFY, LUDWIG von.: "The Theory of Open Systems in Physics and Biology" in F.E. Emery (ed) Systems Thinking. Penguin Books, England 1969, pp. 70, 85.
- BEVIS, F.W.: "An Exploratory Study of Industrial Learning with Special Reference to Work Study Standards". Unpublished MSc Thesis U.W.I.S.T., 1970.
- BEVIS, F.W. and COLLIER, P.I.: An Industrial Survey of Work Study in Wales 1963-1965. An unpublished paper, Welsh College of Advanced Technology, 1966.
- BOLTON, J.E.: Report of the Committee of Inquiry on Small Firms, London H.M.S.O., 1971.
- BOULDING, KENNETH E.: "General Systems Theory: The Skeleton of Science", Management Science, Vol. 2 No.3, April 1956, pp. 197-208.
- BRITISH STANDARDS INSTITUTION: B.S.3138 No.31003, 1969, B.S.I. London 1969.

BRITISH STANDARDS INSTITUTION: B.S.3138 No. 34001, 1969  
B.S.I. London, 1969.

BROOKS, A.A.: "The R.A. Calculator". Work Study and Management Services, No.6, 1975, pp. 202 -208.

BUBB, P.L., HUSSEY, M.K. & SMITH, J.E.: "Just how accurate are your figures?" Management Accounting, September 1973, pp. 348-349.

BUCKLEY, ADRIAN and McKENNA EUGENE.: "Budgetary Control and Business Behaviour", Accounting and Business Research, Spring Edition, 1972, pp. 137-150.

CURRIE, R.M.: Work Study, Pitman 1960

CURRIE, R.M.: Work Study, British Institute of Management, 1972.

CURRIE, R.M.: The Measurement of Work, British Institute of Management 1956.

DEPARTMENT OF EMPLOYMENT: Training for Work Study Practice, H.M.S.O. 1971.

DESMOND D.J.: "The 1950 National Survey of Work Measurement"  
Work Study and Industrial Engineering 1962 pp 323-331

DUDLEY, N.A.: "The Effect of Pacing on Worker Performance."  
International Journal Production Research, Vol.1, (2), 1962, p.60.

DUDLEY, N.A.: Work Measurement: Some Research Studies, Macmillan 1968.

EMERY, JAMES C.: Organizational Planning and Control Systems Theory and Technology, Macmillan, London 1969.

EVANS, F. and BUTTERWORTH, J.: "A Comparison of Consistency of Time Study Observers and M.T.M.2 Analysts". Work Study Management Services Vol.19, No.3, 1975, pp. 99-102.

FAHERTY, B.T, BALL, C.B. & SPARKS, D.A.: The Quality of Work Measurement, Work Study and Management Sciences, June 1970, pp.467-470.

FERTIG, PAUL E.: "Current Values & Index Numbers: The Problem of Objectivity", Research in Accounting Measurement. Ed.Robert J. Jaedicke et al American Accounting Association 1966, p.138.

FERTIG, PAUL E. ISTVAN, DONALD E, and MOTTICE, HOMER J.: Using Accounting Information, Harcourt Brace Jovanovich, New York, 2nd Ed., 1971.

GORDON, MYRON J., and SHILLINGLAW GORDON.: Accounting: A Management Approach, Richard D.Irwin Inc., Homewood Ill, 3rd Ed. 1964.

GRAHAM, C.F.: Work Measurement and Cost Control, Pergamon Press, Oxford 1965.

GREGORY, ROBERT K., VAN HORNE, RICHARD L.: Automatic Data Processing Systems, Principles and Procedures, Wadsworth Publishing Coy. Inc., San Francisco, 1960.

HAGAN, A.M.: Comparative Study of Paced and Unpaced Performance, Unpublished Ph.D. Thesis, University of Birmingham 1962.

HANNON, I.W.: "A Fresh Look at Industrial Engineering";. The Journal of Industrial Engineering, Vol. XIX, May 1968, p.11.

HEES, R.N. VAN & MONHEMIUS, W.: Production and Inventory Control Theory and Practice. The Macmillan Press Ltd., London 1972.

HEYDE, G.C.: "Rest Allowances". Work Study and Management Services No.11, 1973, pp.790-796.

HIGGINS, JOHN A.: "Responsibility Accounting." The Arthur Anderson Chronicle, April 1952, Vol.12 No.2.

HILAL, I.M.: The Factors Affecting Cost Control By Shop Floor Management In The British Iron and Steel Industry. Unpublished PhD Thesis, Manchester University, 1967.

HOFSTEDE, G.H.: The Game of Budget Control, Tavistock Publications Ltd., London 1968.

HOPWOOD, ANTHONY G.: An Accounting System and Managerial Behaviour, Saxon House, England, 1973.

HORNGREN, CHARLES T.: Cost Accounting: A Managerial Emphasis, Prentice Hall International Inc., London 1972.

IJIRI, YUJI.: Foundations of Accounting Measurement. A Mathematical Economic and Behavioural Inquiry, Prentice Hall Inc., New Jersey, 1967.

IJIRI, YUJI and JAEDICKES ROBERT.: "Reliability and Objectivity of Accounting Measures", The Accounting Review. Vol. 41, No.3, July 1966, Page 476.

INTERNATIONAL LABOUR OFFICE: Introduction to Work Study, I.L.O. Geneva, 1964.

ISSAC, S., MICHAEL, W.M.: Hand Book in Research and Evaluation Knapp, California, 1972.

JOHNSON, GLEN L. and GENTRY JAMES A.: Finney & Millers Principles of Accounting, Prentice-Hall Inc., New Jersey 1970.

JONES, GARDNER M. and AWAD, SABER A.: "The Use of Accounting Techniques in Small Firms", Management Accounting, (U.S.), February 1972, pp. 41-43.

KARGER, DELMAR W. and BAYHA, FRANKLIN H.: Engineered Work Measurement, Industrial Press, New York, 1966.

KAST, FREMONTE E. and ROSENZWEIG JAMES E.: Organisation and Management A Systems Approach, McGraw-Hill Inc., New York, 1970.

KATZ, DANIEL and KAHN, ROBERT L.: The Social Psychology of Organizations, John Wiley & Sons Inc., New York, 1966.

KERLINGER, FRED N.: Foundations of Behavioural Research, New York Holt Rinehart & Winston Inc., 1973.

LAZARUS, IRWIN P.: "Nature of Stop Watch Timing Errors". Advanced Management Vol.15, May 1950, as quoted by Mundel, M.E. in Motion and Time Study, Prentice Hall 1950, pp. 332-333.

LEE, T.A.: "Psychological Aspects of Accounting", Accounting and Business Research, Summer Edition 1975, pp. 231 - 232.

LONGHURST, B.J. & KERRIDGE, R.G.P.: "The Application of Work Measurement in Industry". Work Study and Management Services March 1972, pp. 126-129.

LUOMA, GARY A.: Accounting Information in Managerial Decision Making for Small and Medium Manufacturers, Research Monograph 2 National Association of Accountants, 1967.

LYNCH, R.M.: Accounting for Management: Planning & Control, McGraw Hill Book Company, New York, 1967.

MATTESSICH, RICHARD.: Accounting and Analytical Methods, Richard D. Irwin Inc. Ill, 1970.

MAUTZ, R.K.: "The Role of the American Accounting Association in Accounting Research". Research in Accounting Measurement, Ed Robert K. Jaedicke, 1966, Page 2.

MAYNARD, H.B. STEGMERTON, G.J. & SCHWAB, J.L.: Methods Time Measurement McGraw Hill New York, 1948.

MATTESSICH, RICHARD.: "Methodological Preconditions and Problems of a General Theory of Accounting". The Accounting Review, Vol XLV11 No.3 July 1972 pp. 469-487

MINTER, A.L.: A Critical Analysis of Work Study. Unpublished Thesis M.Sc., University of London 1967.

MOONITZ, MAURICE.: "Accounting Postulates". Readings in Accounting Theory Ed. Paul Garner and Kenneth Berg, Houghton Mifflin Co., Boston 1966, pp. 15, 17.

MOORES, B. Assessment of Work Load. Unpublished MSc Thesis, U.M.I.S.T., 1964.

MOORES, B.: Comparison of Basic Time for Six Operations as determined by M.T.M. and Normal Time Study Methods. International Jnl. Production Research, Vol.7 No.2, 1968, pp. 151-157.

MOORES, B.: "Variability in Concept of Standard in the Performance Rating Process", International Journal Production Research, Vol.10, 1972, pp. 169 -173.

- MORROW, R.L.: Time and Motion Economy, Ronald Press, New York 1946.
- MUNDEL, MARVIN E.: Motion and Time Study, Prentice Hall, New Jersey, 1972.
- MURRELL, K.F.H.: "Operator Variability and its Industrial Consequences", International Journal of Production Research, Vol.No.3 1962, p.39.
- MURRELL, K.F.H.: "Fatigue Measurement, Continued Learning and Rating Capability", Report of a Research & Conference 1971, Department of Applied Psychology, U.W.I.S.T., Cardiff.
- MURRELL, K.F.H. and FORSAITH, BEL: "Laboratory Studies of Repetitive Work II; Results from Two Subjects". International Journal Production Research, Vol. 2, 1963, pp. 247-264.
- NICHOLSON, ALISTAIR: "The British Production Cinderella, I - Causes". Management Today, June 1976, pp.
- NIEBEL, BENJAMIN W.: Motion and Time Study. Richard D. Irwin Inc., Ill, 5th Ed., 1973.
- NILAND, POWELL.: Production Planning Scheduling and Inventory Control. A Text and Cases. The Macmillan Co., Toronto, 1970.
- NORMAN, R.G. & BAHIRI, S.: Productivity Measurement and Incentives, Butterworths, London, 1972.
- OLSEN, ROBERT, A.: Manufacturing Management A Quantitative Approach, Internation Text Book Co., Pennsylvania, 1968.
- OPPENHEIM, A.N.: Questionnaire Design and Attitude Measurement, Heinemann, 1966.
- PARKER, VICTOR.: Costing in the Furniture Industry, Pergamon Press, 1965.
- PATON, W.A. and LITTLETON, A.C.: An Introduction to Corporation Accounting Standards Monograph No.3, American Accounting Association, Ann Arbor, Michigan, 1940.
- POPOFF, BORIS.: "Postulates Principles & Rules", Accounting and Business Research, Summer 1972, Pages 186, 187.
- PRESGRAVE, RALPH.: Dynamics of Time Study. 2nd Ed. McGraw Hill Book Co., New York, 1945.
- REDDINGTON, DONALD A.: "Control Methods for Small Business", Management Accounting (U.S.), Vol. 55 1973, pp.15 - 17, 26.
- REUTER, V.G.: "Work Measurement Practices", California Management Review, Part 14, 1971, pp.24-30.
- REUTER, V.G.: "Staffing and Training for Work Study", Personnel Journal (US), Feb. 1971, pp. 144-150.
- ROTROFF, VIRGIL H.: Work Measurement. Reinhold Publishing Corporation, New York, 1959.

SELLTIZ, CLAIRE.: Research Methods in Social Relations, Methuen, 1959.

SEYMOUR, W.D.: "Manual Skills & Industrial Productivity". Institution of Production Engineers Journal, Vol.33, No.4, 1954, pp. 240-248.

SIMON, H.A., GUETZKOW, H., KOLMETSKY, G. and TYNDALL, G.: Centralisation and Decentralisation in Organising the Controllors Department, New York Controllership Foundation Inc., 1954.

SMITH, G.S.: "Measurement of Labour Productivity". Unpublished Paper at Work Measurement Research Seminar, University of Birmingham, Department of Engineering Production, April 1975.

SPACEK, LEONARD.: "Can We Define Generally Accepted Accounting Principles", Readings in Accounting Theory, Ed. Paul Garner Kenneth B. Berg, Houghton Mifflin Coy. Boston, 1966, pp. 82-94.

STARR, MARTIN K.: Production Management Systems and Synthesis, Prentice Hall Inc., Englewood Cliffs N.J. 1965.

SURRY, R.J.: "Design Criteria for the Evaluation of Predetermined Motion Time Systems", Work Study and Management Services, Vol. 7, 1973, pp. 496, 497.

SWANN, K.: Management Attitudes and Techniques in the Small Company. Unpublished MSc Thesis, University of Bradford, 1971.

TIMMS, HOWARD L. and POHLEM, MICHAEL F.: The Production Function in Business, Richard D. Irwin Inc., Homewood Ill, 1970.

TRICKER, R.I.: The Accountant in Management, B.T. Batsford, London, 1967.

VATTER, W.J.: "Postulates and Principles", Readings in Accounting Theory, Ed. Paul Garner & Kenneth B. Berg, Houghton Mifflin Co., 1966, pp. 18-37.

WHITMORE, DENNIS A.: Work Study and Related Management Services. Heinman, London, 1968.

WILLIAMS, HAROLD.: "Developing a Table of Relaxation Allowances", Work Study & Management Services, No.7, 1973, pp. 478 -483.

WOOD, E.G.: "Room for a Good Little 'un", Accountancy, September, 1973, pp. 17-21.