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PRODUCTION IN THE NEW ZEALAND TEXTILE AND GARMENT INDUSTRY
WITH PARTICULAR REFERENCE TO SHORT RUNS

A thesis presented in partial fulfilment of the requirements
for the degree of Master of Technology in Industrial
Management and Engineering at Massey University.

David Peter Maxwell
1977

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CHAPTER 1Acknowledgements

To carry out a research program designed as this one was requires the assistance of many people. The results and success of the study can be attributed greatly to the help and willingness with which so many people have come forth with information and assistance.

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CHAPTER 22.0 Summary

The 1974 New Zealand Textile Institute conference,⁽³⁾ the report of Commission of Inquiry into the Woollen and Associated Textile Milling Industries⁽²⁾ and the working paper for the Textile and Garment industry⁽¹⁾ all identified short run production as a problem in the New Zealand textile and garment industry. In light of the awareness of the problem in the industry this study is the beginning of a program of research looking at production in the New Zealand textile and garment industry.

The initial aims of the first programme of the study (of which this thesis forms the bulk) was; to identify the areas of the industry which require analysis, obtain data upon which further analysis could be based and look at how short run production is treated by the manufacturers in the industry.

There is very little information available upon which such a study can be based. It was decided the best means of information collection was to conduct a survey of the industry. The survey technique chosen was the questionnaire which was sent to the entire industry.

Before constructing the questionnaire a number of interviews and discussions were held with textile and garment manufacturers and other people involved with, or knowledgeable of, the industry. From the interviews and discussions the way in which production is handled and the factors which affect it were isolated.

The questionnaire was then constructed based on the information gained from the interviews and discussions. The questionnaire was distributed to all companies involved with the industry in New Zealand and of these 41% of the companies that received questionnaires returned a completed copy.

Analysis of the questionnaire was then carried out in conjunction with further discussions with people involved with the industry. The analysis of the data is divided into three main sections, the position of the company in the industry;
the way in which production is handled;
the factors affecting the economic performance of the manufacturer.

As the industry is composed of a number of different types of manufacturer it is divided into six major categories:

- i) woolscouring
- ii) woollen milling
- iii) other spinning and weaving mills
- iv) hosiery and other knitting mills
- v) garment manufacture
- vi) other

There were too few replies from categories (i), (ii) and (iii) upon which to base significant analysis. These three categories are treated together as are the hosiery and other knitting mills and garment manufacture categories.

Analysis of the data received from the questionnaires and opinions expressed during discussions reinforced many ideas expressed in previous studies as well as presenting many aspects of the industry previously relatively under researched.

Probably the most distinct factor in the textile and apparel industry is the relatively high number of different products produced by many manufacturers. Many manufacturers, in particular the smaller companies, produce a high number of different products for many different customers. As with the studies that have gone before one of the main recommendations resulting from this study is the rationalisation of the range of products produced by many of the companies.

The rationalisation of the number of products could be brought about in a number of ways:

- a) improved forecasting;
- b) tougher screening of new products at the sample producing stage;
- c) a greater frequency of contact with the customer.

Analysis of the data received illustrates that it is the companies with the above characteristics which produce the relatively smaller range of products. One problem encountered by the textile and apparel industry with respect to product range, is the seasonal and fashion nature of the market. The seasonal aspect presents problems in that for the majority of knitting and garment manufacturers they are required to compile two separate product ranges, this in turn leads to difficulties with production

planning and finance.

The main method of production planning employed by all divisions of the industry is "produce to order", there appears to be room for far more batching of production orders. This survey has shown by way of cost decreases and production efficiency that the situation is such in the New Zealand textile and garment industry that a greater batching of production orders would greatly increase the overall industry efficiency in terms of cost and time per final product. Up till now there has been very little work done on economic production quantities and the variables involved, thus this is one of the areas recommended for further research.

The improvement of production efficiency must be brought about by the improvement of all factors mentioned above, this can only really result from an education programme which is designed to bring the manufacturer into contact with techniques and systems which will increase his production efficiency.

The majority of textile and garment manufacturers in the New Zealand industry can be classified as small manufacturers, especially in the garment manufacture category. The size of company, it is found, has a great bearing on the techniques employed within the company. Many of the small companies rely very much on the "manager/owners knowledge" for the running of the company. The relative smallness allows the manager/owner to be able to carry out production planning and forecasting etc., with very little formal procedure involved. The shorter lines of communication and resulting increased versatility allow the manager to keep relatively good control of his production process. Analysis illustrates that there is still the capacity for further improvement and

New Zealand textile and

garment manufacturers could become recognised as highly efficient producers of short runs.

This study was undertaken with the idea in mind of viewing short production runs not as a problem but rather as an asset and structuring the production process in such a way to make New Zealand a viable competitor in a field where many other countries, because of the size of the country, could not compete.

Analysis has shown that the short production run can be handled efficiently and economically if the correct techniques and programs are adopted.

CHAPTER 3

3.0 Introduction

"The textile and garment industry in New Zealand is a very diverse industry covering a wide variety of products and operations. The industry has the difficulty of being composed of a large number of small individual firms running independently⁽¹⁾".

The above quote is one typical of those found in three articles relating to production in the New Zealand textile and garment industry i.e.

- a) Holden Report⁽²⁾
- b) New Zealand Textile Institute conference 1974⁽³⁾
- c) Working paper for textile and garment industry research⁽¹⁾.

Short run production is an aspect of the industry in New Zealand which has been identified as one which requires further analysis.

"Greatest immediate problem in the textile industry is the production of small batches or runs⁽¹⁾".

It is felt by many people that because New Zealand is a country in which small companies are predominant, short run production could be developed to the extent where New Zealand is a country that can carry out short production runs efficiently. Therefore the initial aim of this study was to look at the textile and garment industry from the point of view, not of eliminating the so called short run but rather as structuring the industry, and techniques used in such a way that short runs could be handled economically.

Such a program of research cannot be carried out in a short space of time thus the following analysis and results were obtained with the view to forming a base for further more thorough on going research. This report is seen as a starting ground upon which further research can be based. The different aspects of production identified will require a new study in themselves to ensure maximum benefit to the industry.

Many aspects of production discussed in this study are known to manufacturers as problem areas or areas in which the New Zealand industry is deficient but as yet nothing collectively has been done to amend the situation.

The areas of production identified in this report are not peculiar to the textile and apparel industry in that many other industries in New Zealand might well experience the same situation.

The research program was funded and initiated by the Physics and Engineering Division of the D.S.I.R. as they, through their experiences, saw short run production as a characteristic of New Zealand industry. New Zealand because of the population of the country and the relatively small size of many companies is capable of dealing with short production runs relatively more easily than the larger more industrialised countries. The common philosophy not too long ago was that mass production was the answer to economic production runs, but this idea is now changing;

"What is resulting in the U.S. is an extraordinary reversal of orthodox economic theory. The need for versatility is making a strong case for small scale production and smaller corporate structures⁽⁴⁾".

Such versatility with respect to production is far more easily obtained in a smaller company⁽⁴⁾ because of the shorter lines of communication.

The textile and garment manufacturing industry was chosen as the industry upon which to base the study for a number of reasons;

- a) short production runs have previously been identified as a characteristic of the industry
- b) the base for the research, Massey University, is in the centre of a high concentration of textile and garment manufacturers
- c) the range of companies, with respect to size and personnel, is considered representative of many other industries hence the results could be projected further than just the textile and apparel industry.

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CHAPTER 4

4.0 Research Design and Data Collection

There is very little literature available that deals with the many aspects of production and the effects they have on the production units in a country the size of New Zealand.

The research for base data was made more difficult by the fact that the situation was common only to New Zealand and countries of a similar size. The situation necessitated first finding out how production is handled in the New Zealand textile and apparel industry then extracting those areas which affect or are affected by short run production.

4.1 Familiarisation with the Industry

To extract the areas of management and production for further research, a series of preliminary interviews was conducted. The textile and apparel industry is an integrated industry and for this reason all sections of it had to be included, i.e. woolscouring, milling, spinning, weaving, knitting and apparel manufacture. The activities of one sector, because it either supplies or is supplied by another sector, are very much effected by the activities of another sector.

Visits to a variety of trade organisations and companies of varying size and activity supplied a wealth of information on areas that were going to require a closer analysis, as well as giving the researcher a basic understanding of the workings of the industry.

The areas previously identified⁽¹⁾ as requiring closer investigation were reiterated by manufacturers and trade associations. Following are the areas identified by the researcher, in the preliminary interviews and previous works⁽¹⁾, as those which require closer consideration in the textile and garment industry:

- Fashion forecasts and consumer demand fluctuations
- Marketing
- Production planning
- Range of products produced
- Stock control - both raw materials and finished product handling and supply

The influence of the retailer
 Preparation of samples
 Production machinery available.

4.2 Method of Data Collection

As there was no data available upon which substantial research could be based a method of data collection had to be sought.

The two recognized means of data collection for such a project are interview and questionnaire.

4.2.1 Advantages and Limitations of the Interview Method

The advantages of using the interview as the means of collecting data for this research program were:

- (a) it may have produced information that would not otherwise have been obtained
- (b) would ensure that the respondent supplied the information in the manner desired by the researcher
- (c) "it is the best method suited for the assessment of personal qualities"⁽³⁾
- (d) would guarantee a relatively high response rate.

However it has certain limitations

- (a) interviewing is a very expensive and time consuming method of data collection
- (b) "it is affected by stresses, strains and other factors affecting either the interviewer, interviewee or both"⁽³⁾.

4.2.2 Advantages and Limitations of the Questionnaire Method

The advantages in using the questionnaire survey technique as a means of data collection for this research project were:

- (a) it is a relatively inexpensive form of data collection
- (b) the respondent may complete the questionnaire in his/her own time
- (c) a correctly constructed questionnaire enables easy computer analysis.

The questionnaire also has its limitations

- (a) it does not provide the facility for the respondent to express his views as well as the interview does
- (b) because of the lack of personal contact the respondent would be less likely to answer it
- (c) it must be very clearly worded to avoid ambiguity or misunderstanding on the part of the respondent.

4.2.3 Limitations in Collecting Production Data for the Textile and Apparel Industry

The textile and apparel industry is very diverse in that different sectors will be affected in different ways by changes in such variables as fashion. For example, the woolscourers would not have to pay quite as much attention to fashions or trends as would the knitting and apparel manufacturers.

Different market sectors affect the way in which a manufacturer handles the production and marketing functions.

It was because of the diversity of the industry and the relatively small number of companies which could be classified together that it was decided to survey the entire New Zealand textile and apparel industry. Also, as there is so very little information available a large number of contingencies must be catered for.

4.2.4 The Choice of Questionnaire as the Survey Technique

In light of the above considerations, the survey technique decided upon was the questionnaire. With the correct approach and adequate preparation the questionnaire should yield useful data.

The following were the reasons for adopting a questionnaire as the means of data collection and the way in which any disadvantages could be overcome:

- (a) because the entire industry would be surveyed (for reasons outlined above) cost and time factors make the questionnaire the most viable
- (b) with extensive publicity and preparation the number of returns would be increased⁽³⁾.

- (c) thorough pre-testing would minimise ambiguity or misunderstanding hence eliminating any problems in this area.

Having decided upon a questionnaire as the means of data collection the reliability of the data depended upon the number of questionnaires returned and that those returned were representative of the industry.

4.2.5 The Questionnaire Construction

Much time and energy was put into the construction of the questionnaire, the aim being, to sell the questionnaire by way of presentation and contents.

Section 4.1 outlines the areas in which work was required. A set of aims was drawn up (see section 4.3.1), the task then was to construct questions which would yield the desired information for further analysis (see section 4.3.2 for question construction).

So as to make the questionnaire easier to answer, where possible, closed questions were used. "Closed questions are those in which the respondent is given a limited number of alternative responses from which he is to choose the one that most clearly matches his situation"⁽⁴⁾.

Other techniques employed to increase the simplicity of the questionnaire and the number of returns were:

- (a) the questions were asked in a logical sequence⁽⁵⁾
- (b) complete confidentiality of all results was guaranteed⁽³⁾
- (c) by way of a pre-questionnaire letter the manufacturer was made to realise that the research would be of assistance to himself (see appendix I)
- (d) each questionnaire was accompanied by a postage paid reply envelope⁽³⁾
- (e) those manufacturers who had not returned the questionnaire were sent reminder letters (see appendix III)
- (f) the presentation of the questionnaire was given careful consideration
- (g) the questionnaire was structured in a way which made analysis very simple

- (h) clear and concise definitions were given of any phrases that may have been misunderstood.

Once the format of the questionnaire had been decided the next step was to ensure that the alternative answers were the correct ones and that all alternatives had been included. The sources used to check that the alternative answers were the correct ones were:

- (a) Department of Statistics publications⁽⁶⁾.
The categories employed in the questionnaire for such variables as, "the total number of employees", were similar to those used by the New Zealand Department of Statistics so that tests of validity could be conducted on the returned questionnaires.
- (b) a wide array of companies, all of differing size and producing a different product, to ensure that all answers were accounted for
- (c) the Market Research Centre, Massey University, Palmerston North.

A first copy of the questionnaire was assembled and then closely examined by different people knowledgeable about the construction and documentation of such a survey technique⁽⁴⁾. Further alterations and scrutiny were carried out before a copy of the pilot questionnaire was assembled.

Twelve copies of the pilot questionnaire were distributed to a number of local textile and garment manufacturing companies of differing size and function⁽³⁾. Those to whom the pilot questionnaires were distributed were asked to complete and return it along with any ideas or problems they had whilst filling it in.

As a result of the pilot test, and the test analysis of data⁽³⁾ received from it, a number of minor adjustments were made before the final version was printed.

4.2.6 Mail List and Advertisements

Whilst the questionnaire was being constructed a comprehensive list of all companies that go to make up the New Zealand textile and apparel manufacturing industry was being drawn up.

Following are the sources from which the addresses of companies were drawn:

- (a) New Zealand Business Who's Who
- (b) New Zealand Apparel Industry's Buyers Guide
- (c) Membership list New Zealand Textile and Garment Manufacturers Federation
- (d) Membership list New Zealand Clothing Institute
- (e) Yellow pages of all New Zealand telephone directories.

Nine hundred and eighty two questionnaires were distributed.

So as to make as many people as possible aware of and interested in the research program, a number of short advertisements were placed in magazines which are distributed throughout the industry.

4.3 Design of Questions

The first step in designing the questions was to compile a set of aims. Analysis of data obtained from properly constituted questions should achieve these aims.

4.3.1 The Aims

The aims which the questions were designed to answer are as follows:

- (1) Obtain data which enables a definition of a short production run for each separate sector of the industry
- (2) Determine what, how and who decides the length of production run
- (3) Determine what members of the industry think is an economic production run
- (4) Does the industry recognize the length of production as a problem and if so how are they tackling it?
- (5) Determine whether there is any relationship between production run length and the success or failure of the company
- (6) Is there any effect upon costs and profits if the length of production run is increased?

- (7) What, how and who decides what is to be produced and when?
- (8) To what extent are such techniques as forecasting, production planning and market research used?
- (9) Determine the relationship between the success of the company and; the number of different products, the number of times a product is produced, and the sector of the market at which the product is aimed.

4.3.2. The Questions

As the textile and garment manufacturing industry is made up of a number of different sectors each sector may require a different response to the above aims. The aims stated above are those around which the questions were constructed. However, information transpired in addition to that required by the stated aims.

Refer to appendix II for a full copy of the questionnaire and covering letter. The questions maybe divided into three main categories:

- (1) Questions concerning the company itself and where it fits into the market
- (2) Questions concerning the way in which the company handles production.

This section begins with the new product design and moves through the steps leading to final dispatch to either the retailer or wholesaler.

- (3) Questions concerned with the economic performance⁽⁷⁾ and growth of the company.

Each question was carefully considered with respect to the following:

- (a) the importance of the information it would yield
- (b) the wording and positioning of the question, in the words of Zaltman. "It is not enough to say the language and vocabulary used should be simple; the important point is whether the question utilizes a vocabulary that is shared by the researcher and the respondent"⁽⁴⁾.

4.4 Validity of Data

A questionnaire must include questions by which the researcher can check the validity and degree of representation of the data obtained⁽³⁾. The validity of data received was tested in three different ways.

- (a) Statistical checks on the number of employees and the state of company ownership;
- (b) post questionnaire discussions with a number of companies to check that the information received was that that was sought;
- (c) checking of the list of companies who returned the questionnaire by a number of people possessing a great knowledge of the New Zealand textile and garment industry.

Following is the result of each of the above validity checks:

The statistical test of significance employed was a χ^2 test checking the number of employees per company and the state of company ownership against figures produced by the New Zealand Statistics Department⁽⁶⁾. The most recent figures available at the time of writing were those of the 1973/74 financial year. To overcome any discrepancies a check was made to see if there was any trend evident in the figures produced for the 1972/73 and 1973/74 financial years.

Statistical tests were conducted on each of the industry categories defined in Question 1 (see appendix II). All tests were done at the 10% significance level.

For a more complete analysis of the χ^2 test see appendix IV.

(a) Woolscouring

Number of employees	Calculated χ^2 =	.02185
Company ownership	Calculated χ^2 =	.7483
	Tabulated χ^2 =	.0158

Thus the sample data obtained is not a valid sample of all woolscourers with respect to company ownership and the number of employees because both calculated χ^2 's are greater than the tabulated value. The main reasons for this result are:

- i) Each set of data could only be divided into two cells (groups) which were common between the Department of Statistics data and that obtained from the questionnaire, hence the very low tabulated χ^2 value.
- ii) The statistics the data was checked against as mentioned before were obtained from the 1973/74 Industrial Production Statistics publication, yet the questionnaire was completed in November and December 1976. This provides a good two and a half years difference in time.

The above reasons apply to all similar χ^2 tests on the other categories following.

It should be noted (appendix IV) that while the state of company ownership remained the same between 1972 and 1974 (i.e. four public and 24 private) the size of company tended to decrease, especially those in the 11 - 50 employees bracket.

(b) Woolmilling

Number of employees	Calculated χ^2	=	4.17
Company ownership	Calculated χ^2	=	1.566
	Tabulated χ^2	=	0.0158

The data obtained is not a valid sample of the total population for the reasons explained above and also, it appears from the data in appendix IV that only the larger woolmilling companies replied to the questionnaire (i.e. those with more than 100 employees).

(c) Other Spinning and Weaving Mills

Number of employees	Calculated χ^2	=	3.035
Company ownership	Calculated χ^2	=	2.869
	Tabulated χ^2	=	0.0158

Again the sample obtained is not a valid representation of the total population statistically, from the data obtained it appears that the larger companies and the publically owned companies replied more than the smaller and privately owned companies. The trend has been for company size to increase (appendix IV), this is probably the reason a greater number of larger companies replied than smaller companies.

(d) Hosiery and Other Knitting Mills

Number of employees	Calculated χ^2	=	.656
Company ownership	Calculated χ^2	=	.079
	Tabulated χ^2	=	.0158

The sample data received is not quite statistically representative of the total population, though the small margin of difference between the calculated χ^2 and the tabulated χ^2 may be explained by the two reasons given in section (a) above. The larger companies replied more frequently than the smaller companies though this may be partially explained by the fact that there is a slight trend to an increasing company size.

(e) Garment Manufacture

Number of employees	Calculated χ^2	=	120.75
Company ownership	Calculated χ^2	=	2.81
	Tabulated χ^2	=	.0158

The great difference between the calculated and tabulated χ^2 values for the number of employees is due to the relatively small number of companies with less than 50 employees that replied. Only 121 out of 530 companies with less than 50 employees replied, whereas 80 out of 107 companies with greater than 50 employees replied. Since 1973/74, there must also have been an increase in the number of companies employing more than 100 people as 38 companies with greater than 100 employees returned questionnaires, while in 1973/74 there was only 27 garment manufacturers with greater than 100 employees.

Thus statistically it cannot be stated that the sample is valid (based on 1973/74 figures) but taking into account the increase in company size a more representative sampling would be found.

(f) Other

As this category includes many companies of varying activities there is not available any statistics upon which validity tests can be conducted.

For purposes of further analysis only the industry categories Hosiery and other Knitting Mills and Garment Manufacture will be dealt with thoroughly, the reasons for this being:

- (a) the number of replies received from the other industry categories (eight for each one) is too few upon which to base any definite results
- (b) the hosiery and other knitting mills and garment manufacture categories contain the greatest number of companies that go to make up the New Zealand textile and garment industry.

As there was no recent statistics available a copy of the list of all those companies that replied to the questionnaire was sent to a number of people, all of whom had a thorough knowledge of the New Zealand industry. They were asked to check through the list and, to the best of their ability estimate as to whether the companies that replied formed a representative sample of the total population.

Following are extracts from two of the replies:

- (8) "and find that you have made what I consider a comprehensive cover of large medium and small companies both in the knitting and make up industry of New Zealand"
- (9) "I would like to congratulate you on the most comprehensive response that you received".

The interviews conducted whilst the questionnaires were being returned corroborated the questionnaire data. All companies that were interviewed illustrated that they had in fact completed the questionnaire in the way intended and checks were made to ensure that the answers given were the correct ones. In all cases where a check had been made the respondent had given the correct answers.

4.5 Analysis of Returned Questionnaires

Total number of questionnaires distributed = 982

Total number of questionnaires completed = 307

Reasons why questionnaires not returned or completed:

Textile and/or Garment Agents or Wholesaler = 94

Address unknown = 75

Company closed down or in recess = 58

Did not want to complete questionnaire = 30

Did not return questionnaire = 448

% Return rate = 40.6%

Previous experience with similar questionnaires has yielded a return rate of approximately 20-35%, thus the number of questionnaires returned in this case was very satisfying.

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CHAPTER 5

5.0 Results and Analyses

As outlined in section 4.4 the analysis of all data received from the questionnaire was done in two parts:

- a) Frequency analysis of the following industry categories: woolscouring, wollen milling and other spinning and weaving mills;
- b) Frequency and further analysis of the garment manufacture and hosiery and other knitting mills industry categories.

A computer package, B6700 Statistical Package for the Social Sciences Version 5⁽¹⁾, was employed to assist in the attainment of the following results and analysis.

All questions from which the data were obtained may be found in the copy of the questionnaire (appendix II).

5.1. Woolscouring, Woollen Milling and Other Spinning and Weaving Mills Industry Categories

The total number of companies that could be classified under this industry category is seventy four, a relatively small number with respect to the total New Zealand textile and apparel industry. Twenty four companies out of seventy four (32.5%) returned a useable questionnaire with a tendency for more larger companies to make a return (see appendix IV).

5.1.1 The Industry Itself

Of the companies that returned questionnaires 43% had been in business for more than forty years, the majority of these falling into the woollen milling and scouring categories. These sections of the industry are relatively old and more traditional in nature compared with most manufacturing industries in New Zealand⁽²⁾. Of the companies that replied the majority in the woollen milling and other spinning and weaving categories are publically owned though the situation is reversed with woolscouring in which 75% of those companies that replied are privately owned.

In the period 1960 to 1970 eleven companies were involved with one or more mergers bringing about a major restructuring of the industry in New Zealand⁽²⁾. The trend has thus been towards an industry concentrated on the larger and more integrated company.

Companies involved with woollen milling and spinning and weaving employ a relatively high number of people. Of the companies that replied 75% of those in the spinning and weaving category employed more than one hundred people whereas all those involved with woollen milling employed more than one hundred people and 75% more than two hundred and fifty. Thus we are dealing with companies which are big employers for New Zealand, remembering that 96% of all New Zealand companies employ less than fifty people⁽³⁾.

The most diversified with respect to the number of different styles of product produced is the other spinning and weaving mills category, three companies producing in excess of one hundred different styles of product. (See Table 5.1). The woolscourers produce very few different products. The woollen millers that replied vary with respect to the number of different products produced. The number of different products ranges from the 1-5 category up to 51-100 with the majority falling in the 21-30 and 51-100 categories.

Table 5.1 The Number of Different Styles of Product

Note that the data is given as a percentage of the total number of companies in each category that produces the corresponding number of styles.

Number of Different Styles	Woolscouring	Woollen Milling	Other Spinning and Weaving Mills
1-5	75%	12.5%	12.5%
6-10	12.5%		12.5%
11-15			12.5%
21-30		37.5%	
31-50		12.5%	12.5%
51-100		37.5%	12.5%
> 100			37.5%
Missing	12.5%		

A number of papers and industry studies previously conducted have indicated that New Zealand textile manufacturers produce too great a range of products:

- "One of the main problems of the yarn and apparel fabric manufacturing industry is that of small scale manufacturing industry producing a large variety of products"⁽⁴⁾;
- from a Trade and Industry Department report; "One of the departments principal aims is to encourage individual companies to rationalise existing product ranges"⁽⁵⁾;
- the Holden report states "In order to improve quality and efficiencies still further some greater degree of specialisation is essential"⁽²⁾.

In light of the number of mergers and amalgamations that have occurred since 1960 there does now seem to be a trend which fulfills the recommendations made above. The fact that 37.5% of the companies from the other spinning and weaving category that replied indicated that they produced in excess of one hundred different products suggests that there is still a lot of room for rationalisation of the number of different products produced. This suggests that there must, in New Zealand at present, be a considerable amount of duplication, not only of products but resources also⁽⁶⁾. Increased specialisation could improve quality, efficiency, turnover and hence profitability and also specialized units are likely to be more controllable.

5.1.2 The Production Run

The average production length varies greatly within each industry category (see Table 5.2) and also varies considerably with size. One of the initial aims of the question relating to length of production run was to determine the manufacturers view as to what is a short production run for each industry category. As the number of companies that replied in the wool scouring, woollen milling and other spinning and weaving mills categories is so small this question does not yield the desired aim.

Table 5.3 illustrates that a manufacturer's idea of a short production run and the minimum length production run he would be prepared to consider are very similar. The minimum production run the company is prepared to consider is in most cases less than half the average production run length.

Table 5.2 The Average Production Run Length

Note the data in this table is given as the number of companies that fall within each category.

	Woolscouring	Woollen Milling	Other Spinning & Weaving Mills
Units	kg's	kg's	Metres
6-25			1
51-100	3		
101-250		1	
251-500		2	
501-1000		1	2
1001-2000		1	
> 2000	5	1	1
Missing		2	4

Table 5.3 Short and Minimum Production Runs

The figures enclosed in brackets are the number of companies within that category who consider that particular range includes the minimum production run length they would be prepared to consider, the other figures are those for the classification of a short production run.

	Woolscouring	Woollen Milling	Other Spinning and Weaving Mills
Units	kg's	kg's	Metres
1-50	3 (2)	(1)	
51-100	1 (1)	1 (1)	2 (1)
101-200	(1)	3 (2)	1 (2)
201-300		(1)	
301-500			
> 500	4 (4)	1	1 (1)
Missing		3 (3)	4 (4)

As can be seen from the data given in Tables 5.2 and 5.3 the spread of average length of production run data is very uneven, thus not enabling a precise definition of a short production run for these industry categories to be made.

The figures obtained for the average production run length in the woollen milling industry agree very favourably with the only other figures obtained. The other figures are those published as part of the Holden report⁽²⁾.

Average length production run
from Holden report = 351 square yards

Average length production run
from this study = 251-500 square metres

A few points of relevance to this study are outlined in the Holden report⁽²⁾.

- a) "The average length of production run achieved here for woven woollens is substantially below that achieved in the United Kingdom;
- b) Four mills in New Zealand had average production runs that were less than the lowest attained by the United Kingdom industry;
- c) The minimum orders accepted by the New Zealand industry compare favourably from the customers' point of view with the United Kingdom industry"⁽²⁾.

Table 5.4 Average Number of Production Runs of the One Product

Note that the results are given as a percentage of companies in each category for whom the average number of production runs falls within the particular category.

Average Number of Production Runs p.a.	Woolscouring	Woollen Milling	Other Spinning and Weaving Mills
1-5		12.5%	37.5%
6-10		62.5%	25.0%
11-20		12.5%	25.0%
21-30	25.0%		
31-50	12.5%	12.5%	
51-75	12.5%		12.5%
Missing	50.0%		

For both the woollen milling and other spinning and weaving sectors the average number of production runs per year for one product is between six and ten whereas for the woolscour sector the average is thirty one to fifty per year (see Table 5.4). It is my view that the high figure obtained for the woolscour category is due to the availability of the raw material, in this case raw wool, and the frequency with which it arrives at the scourers.

The average number of production runs for the woollen milling and other spinning and weaving mills categories is at what would be considered a low level with respect to the availability of raw materials, especially imported yarns etc. The time and expense required to set up a production batch in these categories necessitates as few production runs as possible.

5.1.3 Stocks of Finished Product

In the woollen milling and woolscour categories the average percentage of stock of finished product held was 6-10% whilst the average in the other spinning and weaving category was only 1-5%. (See Table 5.5)

Table 5.5 Percentage of Finished Product Held for Stock

The data is given as a percentage of companies in each category that hold the corresponding percentage of finished product for stock.

Percentage of Finished Product Held for Stock	Woolscouring	Woollen Milling	Other Spinning and Weaving Mills
0	25.0%	12.5%	37.5%
1-5%	12.5%		12.5%
6-10%	25.0%	50.0%	
11-20%		37.5%	25.0%
21-30%			
>30%	25.0%		25%
Missing	12.5%		

The main reason given by many manufacturers for the low stock holding percentage was the hesitancy of the buyer to commit themselves totally in that they will only purchase what they know they can use and if they need any more they will come back later.

5.1.4 If Production Run Lengths were Increased

The data obtained from question 8(e) (see appendix II) indicates that any increase in production run length would have the following effect on the majority of companies that returned a completed questionnaire:

- a) decrease the set up and changeover cost;
- b) decrease the cost due to lost production time;
- c) decrease the cost due to wasted raw materials;
- d) have little effect upon the cost of distribution;
- e) have little effect upon the cost of training;
- f) decrease the price (due to decreased costs)
in the woollen milling category but have little effect upon the other categories.

Thus an increase in average production run length by way of either rationalisation, increase specialisation, improved production planning or broader and bigger markets might bring about a more efficient and internationally competitive industry. As stated in the Holden report "The present generalisation results in overall lower quality, efficiency and profitability for the whole unit and it does not usually increase turnover sufficiently to justify it, nor is it so easily controlled"⁽²⁾.

5.1.5 New Products

The questions relating to sampling and how the product range is assembled (question 9, 10 and 11, appendix II) are of little relevance to the woolscouring industry hence it will be eliminated from this section.

The major influences on the design of new products are different for the woollen milling category to what they are for the other spinning and weaving mill category. Table 5.6 gives the order of effect the different variables have upon the influence of the design of a new product.

Table 5.6 Influence on Design of a New Product*

Woollen Milling	Other Spinning and Weaving Mills
Facilities and skills available	Retailer or wholesalers ideas
Retailer or wholesaler ideas	Facilities and skills available
Specification from customer	Consumer ideas
Consumer ideas	Management or designers opinion
Management or designers opinion	Overseas samples and magazines
Overseas samples and magazines	Specification from customer

* The factors influencing design are given in order from greatest to least influence.

Those enclosed in brackets have equal influence.

Table 5.6 illustrates that the buyer, whether he be a retailer, wholesaler or another manufacturer, has a great deal of influence in the design of new products. The manufacturer must then determine which designs or specifications are the most viable with regards to facilities available and profitability before he decides which to prepare as samples. "It is quite impracticable for the industry of any one country, and in particular a country as small as New Zealand, to match the offering of hundreds of overseas mills. Some end users require a very wide variety, but in general local mills would be able to supply the greater proportion of the local market requirements"⁽²⁾.

The percentage of samples produced that finally reach the market tends to vary considerably for both the woolmilling and other spinning and weaving mill categories. Five out of sixteen companies stated that only 0-20% of the samples produced reached the market, a very low percentage when the cost of sampling is taken into consideration e.g. in the case of woven cloth "if only a five metre sample is woven, the cost will be at least twice as much as the original cloth cost even if only the simplest changes have been made"⁽⁸⁾.

The total percentage of production time devoted to sampling varies from 1% to 10%, the majority of companies replying that only between 1% and 5% of production time was spent on sampling.

From discussions with manufacturers and the data given above, I consider that there is a need for a more thorough screening of products before a sample is actually produced. The manufacturer should define his sampling objectives before committing the samples to be made, the questions must be asked: 'Why do I need to sample?' and "if I do sample will it give me what I require?"

5.1.6 Raw Materials

As stated in section 4.1 the textile industry is a very integrated industry in that one sector often supplies the raw materials for another e.g. woollscourers and woollen millers, and woollen millers and hosiery and knitting manufacturers. The majority of companies (79%) from the woollscouring, woollen milling and other spinning and weaving mill categories that replied to the questionnaire stated that they only experienced shortages of raw materials once or twice a year. This does not agree with what many manufacturers stated during interviews, i.e. that one of the major causes of short production runs was the poor supply of raw materials.

The manufacturers in the woollen milling and other spinning and weaving categories stated that the average time for a raw material order to arrive is one to two months and in some cases as great as three to six months. The long wait for an order of raw materials may indicate a need for more efficient forecasting, production planning and ordering systems. Because of the high degree of integration within the industry the effects of one sector relating to the supply of raw materials will affect the production flow of subsequent sectors.

It would appear that the need for a highly efficient raw materials stock control and ordering system is not as great in the woollscouring division as the average time for an order of raw materials to arrive is two weeks. The fact that many of the raw materials for the woollen milling and spinning and weaving categories are imported greatly increases the average time for a raw material to arrive.

5.1.7 Production Planning

62.5% of all woollen milling and other spinning and weaving mills that replied have a separate production planning department whilst the remaining companies employ the use of planning boards and/or books to assist with production planning. The distribution is different in the woolscour category where the majority of companies that replied used planning boards and books whilst the remainder had either a production planning department, carried out planning based purely on the managers knowledge or produced the orders in the sequence in which they arrived.

Similarly for "the method by which the amount of product to be produced is determined" the woollen milling and other spinning and weaving categories place the different methods in exactly the same order, which in turn is a different order to that obtained from the response of the woolscouring division - see Table 5.7.

Table 5.7 Method by Which Determine The Amount of Each Product to be Produced*

Woolscouring	Woollen milling and other spinning and weaving mills
Produce to Order	Produce to order
Raw material requirements of another company	Produce what think will sell
Use of forecasting techniques	Estimate based on previous years years
Produce to capacity	Raw material requirements of another company
	Indication obtained from first orders
	Use of mathematical forecasting technique
	Produce to capacity

* The method by which the amount of each product is determined is in order from greatest to least favoured.

Those enclosed in brackets have equal ranking.

It is interesting to note that in the woollen milling and other spinning and weaving mills categories the most common method of determining how much to produce is by "producing to order" yet the most common method of production planning is a separate production planning department. This would seem to suggest that the production planning is only sequencing and checking production to ensure that all is produced.

Production planning however is one aspect of the New Zealand textile industry that in previous studies has been identified as being inadequate:

"That mills strengthen their production planning departments and pay more attention to methods whereby customers are advised of pending late deliveries with reasons and alternatives that they could offer"⁽²⁾.

"Reduce lost time and waste material by good production or planning"⁽⁹⁾.

"As the textile cycle is hardly ever predicted, its periods of strongly decreasing and increasing market demands cause great difficulties in the planning of production and the maintenance of the market share"⁽¹⁰⁾.

Production planning forecasting and stock levels must be given very close attention. The textile industry has the added variable of a seasonal demand thus making it even more important to pay more than lip service to production planning.

In the words of the Bolton⁽¹¹⁾ report:

"Production scheduling and purchase control. The lack of these skills frequently makes it impossible to meet delivery dates, avoid unnecessary waiting time and optimise stock levels".

The average frequency with which production is checked against planned production is once a day, though 37.5% of the companies that replied in the woollen milling category and 25% of those in the other spinning and weaving mills sector stated that they only checked production against planned production once a week. For industries with such a range of products to keep a careful check on production flow requires a comparison between planned production and actual production more frequently than once a week.

Interviews and discussions with manufacturers indicated that the problems the textile manufacturer encounters in New Zealand with respect to production planning are:

- a) demand for a product often only lasts up to six months a year;
- b) the fashion nature of the industry encourages a large number of different products;
- c) many late orders may be received due to the buyer not being prepared to over commit himself in the beginning, this is greatly effected by the economic climate at the time;
- d) many of the raw materials are imported hence a long time between placing an order and receiving it;
- e) because of the large number of products produced per manufacturing unit either very versatile or a wide range of machinery is required hence creating scheduling and loading problems.

Table 5.8 The Factors Affecting the Length of Production Run*

Woolscour	Woollen Milling	Other Spinning and Weaving Mills
Size of order	Size of order	Size of order
Seasonal aspects	Production planning	Machine capacity
Machine capacity	Sales department	Sales department
Sales department	Machine capacity	Production planning
Raw materials supply	Seasonal aspects	Condition of machinery
Production planning		
Transport factor		

* The factors affecting the length of production run are given in order from greatest to least effect.

In response to the question regarding the effect difference variables have upon the length of production run (question 17 appendix II) the variable having greatest effect on all three industry categories was the size of customer order (see Table 5.8).

The fact that the size of the customer order has such a large bearing upon length of production run again indicates that management of production is not as strong as maybe it should be for such industries as woollen milling and spinning and weaving.

Of the companies in the woolscouring, woollen milling and other spinning and weaving mills categories that replied to the questionnaire 62.5% stated they were attempting to increase the length of production run by seeking new or greater export markets. The findings of the Holden Committee investigating the New Zealand woollen and associated textile milling industry⁽²⁾ showed that the volume of exported woollen mill products was too small a percentage of its total output. The committee recommended that a much faster growth in exports must be gained, the result given above indicates that this is in fact what the manufacturers are looking at.

All but one of the woollen milling companies that replied also indicated that they were attempting to increase production run length by improving their production planning. The only other method by which the majority of companies stated they were attempting to increase production run length was by seeking new markets within New Zealand.

5.1.8 The Finished Product

The questionnaire analysis indicated that the majority of final product produced by the woolscour either goes to another manufacturer or is dispatched for export, whereas in the case of those companies that replied in the woollen milling and other spinning and weaving categories there was a number of destinations given for the majority of the final product. The different destinations given were; other manufacturer, wholesalers, many different retailers and the export market. The high number of companies that pass the final product to retailers and wholesalers is probably one of the major causes of the great number of different products produced, remembering that the retailer and wholesalers ideas have great influence on the design of new products.

Disregarding the woolscouring industry less than half the companies that replied said they were in communication with their major customers approximately once per week.

The remaining manufacturers stated that they were in contact approximately anywhere between once every two weeks to four weeks. Greater frequency of communication would ensure that the manufacturer was aware of such things as what orders the customer would be placing in the near future and whether certain orders should be given greater or less priority, all of which would greatly facilitate production planning and raw materials purchasing etc. The manufacturer should in turn also be in constant contact with his suppliers.

Of the manufacturers in the woolscouring, woollen milling and other spinning and weaying categories that replied to the questionnaire 79% stated that should they not be able to meet an order for a finished product on time that order is given a high priority in the production schedule. Improved communication and, production planning could again alleviate this. If a company is late with the delivery of an order and that order is given a high priority this then places pressure on the production flow as other production runs may well have to be interrupted or rearranged to get the late order through.

The average turnaround time for an order of finished product (i.e. the time between the placing of the order and the receiving of that order by the buyer) varies for each industry category. Whether the order can be supplied from stock or whether it must be a new production order will affect greatly the turnaround time. 87.5% of the woolscourers that completed questionnaires stated that the average turnaround time was between one and two months and of these 62.5% had an average less than one month. The average turnaround times for the other two categories are considerably greater; woollen milling, only 25% of the companies had a turnaround time between one and two months whilst 62.5% had a turnaround time between two and four months, in the other spinning and weaving mills category 50% had a turnaround time between one and two months or less whilst 25% stated two to four months and a further 25% stated four to six months.

5.1.9 Use of Management Techniques

The textile industry is by New Zealand standards traditional and relatively old. The protection given the industry in New Zealand would appear not to have created the need for the manufacturers to adopt dynamic management techniques.

Of the woollen millers and spinning and weaving mills that replied to the questionnaire only 32% employed any form of market research, against this 72.5% of the companies had in action some form of worker incentive scheme. Maybe the reason for the lack of marketing orientated techniques is that given in the Bolton report; referring to the wool textiles industry "Marketing considerations in particular have given the large firm an advantage in the large volume business of the industry. Long production runs, which in this industry tend to be a more important source of cost savings than economies of scale, can only be achieved by firms with a strong market orientation and organisation"⁽¹²⁾.

An increase in the use of market research should in my opinion assist the industry with respect to rationalisation of the number of products produced. Within the New Zealand industry there is a great deal of duplication of expensive plant which has little utilisation⁽⁴⁾, increased feasibility and market analysis would decrease this wastage and hence increase the efficiency of the industry.

Perhaps a more efficient industry structure should be that suggested by J.K. Scott in his presentation to the National Research and Advisory Council⁽⁴⁾.

"It is felt that the industry cannot expect Government protection and assistance without helping itself. It would be better for the future of the industry if there was a rationalisation of products between companies e.g. agree that say two companies manufacture blankets and a further two upholstery fabrics, and so on".

This view is backed up by G.H. Datson of the Department of Trade and Industry.

"In my view, there is still considerable scope for amalgamation in the textile industry, particularly at the spinning and weaving end"⁽⁶⁾.

Of those companies in the woollen milling and other spinning and weaving categories that replied to the questionnaire, 69% used work study as a means of increasing efficiency. The areas of work study employed were not indicated thus comment cannot be made as to whether there is room for improvement here.

As only three companies from the woolscouring, woollen milling and other spinning and weaving categories offered data on economic performance no analysis could be carried out for this section.

5.2. The Hosiery and Other Knitting Mills and Garment Manufacture Industry Categories

The analysis of data received from those manufacturers that replied in the other knitting mills and hosiery and garment manufacture categories is considered in three main sections:

- a) general factors such as how the number of employees and the years in business affect the company;
- b) the position with respect to the actual production flow, from sampling through to the final product;
- c) the economic performance of the companies and how this varies with other variables for which data was obtained.

Note that a 10% significance level is used for all statistical analysis.

5.2.1 General Factors Affecting the Company

The number of questionnaires returned from companies in the hosiery and other knitting mills and garment manufacturing sectors was great enough to enable a quantitative definition of short run production to be made.

A previous attempt has not been made at quantitatively defining a short production run for the New Zealand textile and clothing industry. The only definition I was able to locate was one given by H.N. Rimmer at the 1974 Textile Institute conference though it refers to the knitwear industry I would consider it also applicable to the garment manufacture sector of industry as the factors affecting the manufacturer (i.e. fashion, raw materials supply etc) are very similar.

The term "short-runs" means different things to different people. What may be regarded as a long run in say the Womens Knitted Outerwear field may seem impossibly short to the Mens Cotton Underwear Manufacturer. Obviously the question of how long is a short run is impossible to answer.

From the viewpoint of manufacturing efficiency no production run could be too long, but as style diversity is a necessary part of the knitwear business, we must reconcile ourselves to the fact that production runs will always be shorter than the optimum length"⁽¹⁴⁾.

To make progress; I will arbitrarily assume that 80% of all New Zealand production runs are short. Thus from the data received from the questionnaire the following definitions are formed (see question 8b appendix II):

A short production run for the other knitting mills and hosiery category 720 units.

A short production run for the garment manufacturing category 545 units.

For derivation of the above see appendix V.

Table 5.9 Average Production Run Length

(Number of companies whose average production run falls within the given category.)

Length of Production Run (Units)	Hosiery and Other Knitting Mills	Garment Manufacture
1-5	1	5
6-25		9
26-50	1	9
51-100	1	33
101-250	3	44
251-500	5	35
501-1000	5	30
1001-2000	2	15
> 2000	1	8
Missing	12	7

The data obtained from the returned questionnaires shows the longer a company has been in business, the greater are the following:

- the degree of sophistication of production planning (see section 5.2.2);
- average number of production runs of the one product;
- number of different products produced;
- number of employees;
- current and fixed assets;
- sales;
- average time for raw material to arrive;
- time to fulfil an order for finished product;
- use of management techniques e.g. market research and work study.

Many of the above variables are discussed in section 5.2.2. but those relating to the position of the company in the industry will be dealt with in this section.

Regarding growth of New Zealand small manufacturers, M.I. McDonald says the following:

"Most New Zealand manufacturing firms established in the last quarter century grew out of someones interest in making something for which there was a market. The driving force has been the desire and ability to manufacture, rather than efficient business organisation. With industrial expansion, this emphasis has often led to the making of a wide range of products under one roof."⁽¹⁵⁾

With respect to the New Zealand hosiery and other knitting mill and garment manufacturers the above statement is supported by the following views expressed to me by members of the New Zealand industry.

"The majority of New Zealand textile and clothing manufacturers offer too wide a range of products"⁽¹⁶⁾

"There should be a rationalisation of the number of products offered, the question should be asked what market are we in?"⁽¹⁷⁾

"In New Zealand we produce a wider range of garments than we need⁽¹⁸⁾."

Table 5.10 Years in the Industry by the Number of Different Styles of Product

The data enclosed in brackets is that relating to the hosiery and other knitting manufacturers that returned questionnaires, that not enclosed in brackets relates to the garment manufacturing category.

Products Years	1-5	6-10	11-15	16-20	21-30	31-50	51-100	>100
0-5	7(3)	5	5(1)	6	3	3	6 (1)	7
6-10	2	6 (2)			3(1)	4(1)	4 (2)	3(2)
11-15	3(1)	3	2			2(1)	4	8
16-20	1	2	1	1(1)	2	3	5 (2)	6(2)
21-30	9(1)	7(1)	3	2(1)	2	4	10 (1)	12(1)
31-40	3	3	2	1	2	2(1)	3	6(1)
> 40	1(1)	2	1	3	1		7	6(3)
Total	26(6)	28(3)	14(1)	13(2)	13(1)	18(3)	39 (6)	48(9)

A reason given for the relatively high number of different styles of products produced by each company was:

"Many manufacturers produce as broad range of products and supply to many different sources as a form of insurance, i.e. if one product or buyer fails you have the others to fall back on⁽¹⁹⁾."

This philosophy seems to suggest that there is an inadequacy with respect to pre-production planning in the form of forecasting and determining the viability of a product(s) for a certain market(s).

Table 5.11 Number of Employees by the Number of Different Styles of Product

The data enclosed in brackets is that for the hosiery and other knitting mills category, that not enclosed in brackets being for the garment manufacturing industry.

Employees Products	< 15	16-30	31-50	51-100	101-250	> 250	Total
1-5	8 (3)	5 (3)	2	5	6		26 (6)
6-10	8 (1)	5	3	7 (2)	5		28 (3)
11-15	3 (1)	3	4	4			14 (1)
16-20	2	1 (1)	4	3	(1)	2	12 (2)
21-30	3	3	1 (1)	2	4		13 (1)
31-50	3 (1)	5	4 (1)	4	2 (1)		18 (3)
51-100	9	9 (2)	7 (3)	10 (1)	2	2	39 (6)
> 100	6	6	15	6 (4)	10 (2)	5 (3)	48 (9)

For both the garment manufacturing and hosiery and other knitting mills categories the number of different styles of product increases significantly with the number of employees in the company (see Table 5.11). This would seem to suggest that as a company grows so too does the number of products, growth does not seem to bring about any great degree of specialisation.

"With industrial expansion, this emphasis has often led to the making of a wide range of products⁽¹⁵⁾",..... than later from the same source. "In turn, the wide range of products has forced the manufacturer to buy universal equipment and this has led to similar products being made by too many manufacturers⁽¹⁵⁾".

The degree of sophistication of production planning for the purposes of this study is measured on a four point scale, one are being the most sophisticated and four the least sophisticated.

Following is the scale:

1. A separate production planning department;
2. Use of planning boards and/or books administered by the Manager or Foreman;
3. Manager or foreman's knowledge without the use of planning boards or books.
4. Orders processed in the sequence in which they arrive.

Statistical analysis shows that for the garment manufacturing category the degree of sophistication of production planning is dependant upon the following:

number of years the company has been in business;
 number of styles of product produced;
 average production run length.

Regression analysis gives the following relationship:

$$\begin{aligned} &(\text{Sophistication of production planning}) = \\ &-.026(\text{Years}) - .0003(\text{Average run}) - .003(\text{Products}) + 3.36. \end{aligned}$$

For the above, the multiple regression coefficient is .38 and the analysis of variance of the regression is $F = 10.44$ which is significant at the 5% level. The equation illustrates that for the garment manufacturers the older the company the larger the run length and the greater the number of products the greater is the degree of sophistication of production planning. The major dependance is on the age of the company.

The results obtained in the above regression analysis support the views expressed by a number of people involved with the industry;

"Typical New Zealand manufacturers start from small beginnings and steadily grow. The growth is not accompanied by any major change in organizational techniques, the owner/manager uses basically the same management techniques for thirty employees as what he did for three employees." (18)

"A company only changes its structure with regards to production when it has to. As the company grows the lines of communication increase in length and the company staggers along making production planning very difficult." (20)

Referring to the growth of New Zealand manufacturers the following has been written:

1) "Because the management can no longer carry all the facts in their heads, they cannot balance the companies commitments against its manufacturing capacity, they tend to promise too much and deliveries become progressively later.

2) A wide range of work is undertaken with little or no knowledge of the relative profitability of different jobs. (15)

The above quotations seem to suggest that New Zealand entrepreneurs manage by crisis and necessity, though this is a very powerful incentive to make the correct decision. If a manufacturer wishes to continue growing he must look very carefully at the adequacies of such functions as production planning and the amount of administrative delegation that is to be employed.

Almost 70% of the companies that replied to the questionnaire in the hosiery and other knitting mills and garment manufacture categories are small companies (i.e. less than fifty employees⁽³⁾) thus much of the analysis is directed towards the so called smaller companies.

Analysis of the data received showed that for both the hosiery and other knitting mills and garment manufacturing categories that the following increase significantly with the number of employees of a company:

Sales

Time to fulfil an order

Time spent on sampling as a percentage of total production time

Percentage of samples that reach the market

Average time for raw materials to arrive

Frequency of raw materials shortages

Fixed and current assets

Profit

Number of styles of product produced

Degree of sophistication of production planning.

Statistical analysis carried out on the data received also shows that the average number of production runs of anyone product decreases as the number of employees increase.

Thus though the larger companies do not have, on the average, as many production runs of the one product as the smaller company it does take longer for an order to be fulfilled by a larger company. The relative advantages and disadvantages of a small company with respect to production in the New Zealand clothing, hosiery and other knitting mill industries are outlined below.

Advantages:

- i) Intimate, informal nature of small-plant relationships⁽²¹⁾;
- ii) Flexibility with respect to employees and their adaptability to a new job⁽²¹⁾;
- iii) Simplicity of production management control and problems;
- iv) The lesser need for sophisticated sampling and planning techniques as most knowledge can be retained in the managers head or close at hand;
- v) The quicker average turnaround time for an order of final product;
- vi) The smaller time required for a raw materials order to arrive;
- vii) Worker interest and morale are generally higher⁽²¹⁾.

Disadvantages:

- i) The fragmentation of the production flow;
- ii) The ease with which they may be swamped by the big manufacturer⁽¹⁹⁾;
- iii) Financial limitations, many small manufacturers are undercapitalised⁽²²⁾;
- iv) Limited need for management ability and vision because there is not the need for formalised techniques;

- v) "Entrepreneurs tend to work by crisis and necessity"⁽²³⁾.

In the words of W. Coffey:

(23) "All the research overseas shows that the efficient size of a business varies significantly. The best in terms of size varies with the technology, the product and the nature of the market."

Analysis shows that the average production run length increases significantly with the number of employees per company in the garment manufacturing category though this relationship is not significant at the 10% level for the hosiery and other knitting mills category.

Table 5.12 Average Production Run Length by Number of Employees

Garment Manufacturing - Frequency analysis of the average production run length against the number of employees.

Employees Run Length	<15	16-30	31-50	51-100	101-250	>250
1-5	4		1			
6-25	3	1	3	1		1
26-50	5	2	2			
51-100	7	13	7	5	2	
101-250	13	8	9	9	7	
251-500	4	5	5	13	7	1
501-1000	3	5	6	7	6	6
1001-2000	2	2	4	4	3	
> 2000	1		1	2	3	1
Total	42	36	38	41	28	9

Note that the average production run length is measured in number of units for both the garment manufacturing and hosiery and other knitting mills categories.

For the garment manufacturing sector the average production run length increases significantly with the frequency of contact the manufacturer has with his customers. This would seem to indicate that the greater frequency of contact with customers enables the manufacturer to group orders of the same product which should in turn increase the efficiency of the production process.

Regression analysis derived the following equation for the relationship between average production run length and:

the number of employees;

average number of times a month the manufacturer is in contact with his major customers.

The garment manufacturing category only.

$$\begin{aligned} (\text{Average production run}) &= 1.995 (\text{No. of employees}) \\ &+ 13.45 (\text{Frequency of contact}) + 253.61. \end{aligned}$$

The above equation has a multiple regression of 0.31 and the analysis of variance of the regression gives $F = 10.29$ which is significant at the 5% level.

The equation shows that the larger the company (with respect to the number of employees) and the greater the frequency of contact between manufacturer and customer and the greater is the average production run length. The major dependance is on the frequency of contact.

Previous studies in both the garment manufacturing and hosiery and other spinning mills categories have identified the broad range of products produced by New Zealand manufacturers as a major problem. Table 5.11 illustrates the distribution of the number of different styles of product produced per company.

Following are a number of quotes relating to the broad range of products produced by the New Zealand industry.

"Overseas comments had been received on the small batch problem, such as the need to limit the number of blends and cutting down the variations in pattern and colour at early stages"⁽²⁴⁾.

"Another method of increasing batch sizes would be to reduce the large variety of products at present available"⁽⁴⁾.

Interviews conducted during the research also indicated the same problem:

"Some products produced by some companies are not economic in terms of the number produced and the associated cost"⁽¹²⁾.

"If New Zealand import restrictions were relaxed some companies would be forced out of business because they produce too many products at too high a price"⁽¹⁶⁾.

The small manufacturer and the short production run play a very important part in the New Zealand textile and clothing industry though I feel that where ever possible the short production run should be avoided or prevented. The research report on British small businesses perhaps summarises it very well:

"In the sector of the industry affected by changes of fashion the greater flexibility of the smaller firm was a positive advantage"⁽¹²⁾.

On the point of increased production run length the same report states:

"In many consumer markets it has become apparent that the consumer is quite prepared to accept standardisation, and a reduction in variety, if this allows price to be cut by the exploitation of economies of scale and cost savings produced by long runs"⁽¹²⁾.

Perhaps ideally the most efficient industry structure, with respect to the distribution of company size, for the New Zealand garment, hosiery and other knitting mills industry categories would be to have the smaller companies producing the products affected by fashions, thus enabling the greater flexibility and relative ease with which a change can be implemented of the smaller company to be used to its fullest. One should remember such an industry structure may well still require a thorough look at all products to be produced and all uneconomic products screened from the product range.

Production planning and the forecasting of market demand might also need to be paid closer attention so as to offset the extra increased cost of the short production run (for further analysis on production planning and marketing see section 5.2.2).

5.2.2 The Product; From Sampling to Distribution

a) Forecasting and Sampling

Forecasting and sampling is the area of textile and garment manufacture upon which the least amount of study has been previously carried out, there is very little literature available especially in the field of garment manufacture. Consequently this section is mainly a summary of the results received from the returned questionnaires and the interviews.

In both the garment manufacturing and hosiery and other knitting mills the most common influence on new product design (see question (9) appendix II) is overseas samples and magazines. 73% of the garment manufacture category and 87% of the hosiery and other knitting mill category that returned completed questionnaires stated overseas samples and magazines as a major design influence, the majority of companies also stated management or designers personal opinion as a major influence (see table 5.13).

Table 5.13 Influence on the Design of New Products

The different influences affecting the design of new products are ranked in order from the most common influence to the least common.

Rank	Garment Manufacturer	Other Hosiery and Knitting Mills
1	Overseas samples and magazines	Overseas samples and magazines
2	Management or designers personal opinion	Management or designers personal opinion
3	Ideas from retailer or wholesaler	Facilities and skills available
4	Facilities and skills available	Consumer ideas
5	Consumer ideas	Ideas from retailer or wholesaler
6	Given specification by customer	Given specification by customer

In the garment manufacturing sector and to a lesser extent the other hosiery and knitting mills category it is common for the designer or in the case of the smaller firm the owner/manager to journey overseas a number of times each year to investigate the particular season's trends, they then sometimes modify the garment or fabric design before preparing a sample. The samples are then gathered together and shown to the customers.

Approximately 75% of the garment manufacturing companies that replied to the questionnaire stated that up to 90% of the samples produced actually reached the market. In the hosiery and other knitting mills category 90% of the companies that replied indicated that up to 90% of the samples produced actually reached the market. When asked whether many samples were not produced because of insufficient orders many said they would attempt to fulfil nearly all the orders that were placed with them, it was only the larger companies that indicated they would not accept orders if the total production order was below a certain level. This is in line with many smaller manufacturers attitude in that they supply a wide range of products to many different customers as a form of security to themselves.

The New Zealand manufacturer could be in need of a body or organisation whose responsibility it is to forecast the trends and needs of the market then in some way fit this in with those of the manufacturers. In this way the manufacturer would then be able to decrease his range of products thus decreasing his sampling and design costs and increasing the size of production orders.

From discussions with manufacturers and others involved with the industry I was able to determine the following as a typical sampling sequence for a manufacturer in the garment manufacture and hosiery and other knitting mills categories.

Either the designer or manager/owner makes a trip overseas to view the trends and style of product that is evolving.

With the assistance of a number of overseas magazines the sample range is sketched out.

The sample range is finalised and any products that are considered not worth while dropped.

The sample range is handed to the salesman or equivalent who in turn visits the company's clients presenting them with the range, obtaining their views and taking orders.

As the orders arrive back at the factory they are surveyed and maybe any samples not selling very well dropped from the range.

Part of the clothing industry and to a lesser extent the knitting industry is faced with the problem of being in the fashion field hence often not a lot of emphasis can be placed on any sales predictions that might be made. Those companies involved with more stable products with respect to their demands should be able to make reasonably accurate sales predictions and hence not feel the need to produce a wide range of products.

It is the opinion of many people involved with the industry that in many companies the screening of products is not thorough enough. The larger companies tend to have the more thorough screening processes e.g. one large company has more than four screenings, each one relating to a different aspect of the product and getting tougher as time goes on. Perhaps a more profitable approach to forecasting could be a greater marketing orientation in that the manufacturer would get to know better his customers trends with respect to sales and market then in turn build up a knowledge which would enable him to recommend to the customer what will sell and why. In this way the manufacturer would not have so many unknowns because he himself will have a better idea of what is going to sell and in what quantities.

b) Production

By far the most common method of determining the amount of final product to be produced (see question 12 appendix II) is to produce to order (see Table 5.14). 83% of all manufacturers in the hosiery and other knitting mills category that replied and 72% of all manufacturers in the garment manufacturing category that replied indicated that producing to order was the method by which they determined the amount of final product to be produced.

Table 5.14 How the Amount of Final Product to be Produced is Decided

The ways in which the amount of final product to be produced is decided is ranked in order from the most common to the least common.

Rank	Garment Manufacture	Other Hosiery and Knitting Mills
1	Produce to order	Produce to order
2	Produce what manager/sales manager thinks will sell	Produce what manager/sales manager thinks will sell
3	Indication from the first orders	Indication from the first orders
4	Estimate based on previous years	Estimate based on previous years
5	Produce to capacity	Produce to capacity
6	Use of mathematical and marketing forecasting techniques	Use of mathematical and marketing forecasting techniques
7	Raw materials supply of another Division/Company	Raw materials supply of another Division/Company

Those enclosed in brackets have equal ranking.

The ranking of the two variables which indicate some form of forecasting, i.e. "estimate based on previous sales" and "use of mathematical and marketing forecasting techniques" in Table 5.14 illustrate the relatively small usage of formalised forecasting techniques in the New Zealand clothing, hosiery and knitting industry. This lack of formalised forecasting may be attributed to the large number of so called small companies in the New Zealand industry who feel they need no formal plans⁽³⁾. Some form of demand trend or use of some forecasting technique should enable the manufacturers to increase their control over the market which in turn would most probably lead to a better organized production flow.

"The importance of a well-balanced and profitable product range designed to meet the objectives of the Division/Company is so great that neither the planning nor the control of the range can safely be the complete responsibility of any one person or function"⁽²⁵⁾.

Rimmer goes on to say:

"Our ability to make satisfactory profits is profoundly affected by the physical attributes of our products"⁽²⁵⁾.

Thus the selection of the correct products to be produced and in the correct quantities is fundamental to the operation of a successful garment, hosiery or knitting manufacturer. More formalised methods of product design and quantities of product decisions should make the decisions considerably easier and more reliable.

From my discussions with manufacturers I learnt that generally raw materials are ordered on the basis of an indication of sales from the first few orders and for those raw materials that are either imported or take a long time to arrive orders are placed for the equivalent of what they think will sell.

Following are quotes from manufacturers on how materials are ordered:

"Raw materials requirements are gauged from orders, the amount often must be an estimation. Raw materials ordering is vital in times of inflation as we won't place an order unless we are certain"⁽²⁵⁾.

"All raw material requirements are based on orders"⁽²⁶⁾.

"If we are out of stock we order it and in the meantime produce garments for which we have stock on hand"⁽²⁷⁾.

Table 5.15 Shortages of Raw Materials by Time for Raw Materials to Arrive

The data relating to the hosiery and other knitting mills is enclosed in brackets, that relating to the garment manufacturing category is not enclosed in brackets.

Shortage of Raw Materials	Time to Arrive (weeks)						Total
	0-2	2-4	4-10	10-24	24-40	>40	
Never	5 (1)		3	15	(1)		23 (2)
1-2/year	11	8 (2)	21 (5)	44 (5)	3	1	88 (12)
once/month	2	6	17 (3)	24 (6)	1		50 (9)
once/week			3	4			7
continuously	2		6	6 (2)	1	1	16 (2)
Total	20 (1)	14 (2)	50 (8)	93 (13)	5 (1)	2	

For the hosiery and other knitting mills category the frequency of raw materials shortages (shortages per year) is related to the following:

degree of sophistication of production planning
(see section 5.2.1);

and the time for raw materials to arrive.

$$\text{R.M. shortage} = 1.239 (\text{Time}) - 3.737 (\text{Production planning}) + 12.274.$$

The above regression equation has multiple regression values of .35 for production planning and .40 for both time for raw materials order to arrive and production planning. $F = 3.5$ which is significant at the 5% significance level. The above equation shows that for the hosiery and other knitting mills category as the time for raw materials to arrive and degree of production planning sophistication increases, so to does the frequency of raw materials shortages.

As can be seen from Table 5.15 approximately 87% of the companies that replied in the garment manufacturing category have raw material shortages once per month or less whilst only 93% of the companies that replied in the hosiery and other knitting mills category have shortages once per month or less.

In the hosiery and other knitting mills category the frequency of raw materials shortages increases significantly with the average production run length whilst in the garment manufacturing category the frequency of raw materials shortages decreases significantly with the average production run length; may be this is due to the extra stocks that are held by a garment manufacturer and that he will produce what he has stock available for.

Raw materials requirements could be better controlled and managed if the exact amount required was known, thus reliable forecasting should create cost savings for the manufacturer in that he would be able to order in economic quantities and ensure that the materials arrived in time and in a sufficient quantity. Shortages of raw materials leads to interruption, fragmentation and adjustment of any production plans in that production of that particular product must cease until the required materials arrive.

"Fluctuation in the demand and supply of raw materials provides a disincentive to the introduction of capital intensive methods of production"⁽¹²⁾.

The situation, with regards to raw materials, is more difficult for the manufacturer in the fashion sector of the industry than those involved with staple goods manufacture because of the greater number of variables which affect sales⁽²⁸⁾. Thus the need for a good knowledge of the market and the likely effect of the product upon it is very important. As a small company can be more versatile and flexible⁽²⁹⁾ in its operations this would seem a good basis upon which to orientate those companies that produce for the fashion section of the market.

For the garment manufacturing industry the degree of sophistication of the production planning technique used increases significantly (as shown in the regression equation in section 5.2.1) with the number of employees and the average production run length. For the hosiery and other knitting mills category the degree of production planning increases significantly with the number of employees.

Table 5.16 Sophistication of Production Planning by Number of Employees

The data relating to the hosiery and other knitting mills is enclosed in brackets that relating to the garment manufacturing industry is not enclosed in brackets (see question 15 and question 4 appendix II).

Production Planning		Number of Employees						Total
		< 15	16-30	31-50	51-100	101-250	> 250	
1	Production Planning Department	1	3(2)	2	9 (3)	10(2)	6(2)	31(9)
2	Boards/books and Manager/Foreman	5(4)	9(1)	16(2)	18 (3)	14(2)	3(1)	65(13)
3	Manager/Foreman Knowledge	17	16(1)	12(2)	12	3		60(3)
4	Produced order of arrival	17(1)	9(1)	10(1)	2 (1)	1		39(4)

As can be seen from Table 5.16 the most common method of production planning is the use of planning boards and books administered by the manager or foreman, the larger companies tending to make more use of a separate production planning department.

"The situation may develop where a business may have drastically to revise the how, for whom, what product and how much etc., of its production process at much shorter intervals. And these intervals will become even shorter as the pace of change accelerates into the future"⁽³⁰⁾.

Remembering that for both the garment manufacturing sector and the hosiery and other knitting mills sector the degree of sophistication of production planning increases with the average length of production, the use of planning boards and books by the manager or foreman might well be the best form of production planning in light of the quote above. The use of planning boards and books by the manager or foreman in a small company should enable the production process to be reasonably flexible in that the person responsible for planning has very close contact with the production department.

"The small plant should take advantage of informal, personal contacts. Much information can and should be carried in the manager's or foreman's head. But production cannot be effectively managed in a hit or miss, hip pocket manner"⁽³¹⁾.

Any risk involved with a production plan can be minimised by basing the production plan on a demand forecast which is known to be reliable⁽¹⁴⁾.

Of those companies that replied in the hosiery and other knitting mills category 83% checked actual production against planned production at least once a week, whilst 75% of those companies in the garment manufacturing division that replied checked planned production against actual production at least once a week.

c) Production Run LengthsTable 5.17 Production Run Lengths

The data is given as the point below which 80% of the companies that replied to the questionnaire have the average production run, the minimum production run and what they classify as a short production run (see questions 8(b), (c) and (d) appendix II). All production runs are measured in number of units.

	Garment Manufacture	Hosiery and Other Knitting Mills
Average Production Run	545	720
Short Production Run	135	330
Minimum Production Run	133	325

The minimum production run 80% of the companies would accept is very similar to what 80% of the companies replied they would classify as a short production run. 6% of the garment manufacturers and 10% of the hosiery and other knitting mill manufacturers indicate that the minimum production run they would consider is in excess of 500 units.* When analyzing such data as this it must be remembered that manufacturers in both the fashion and staple product markets are included in the population.

Of those companies that replied to the questionnaire 50% of the garment manufacturers and 42% of the hosiery and other knitting mills category ranked the size of customer order as the major determinant in the size of production run (see Table 5.18). This agrees very well with Table 5.14 which outlines the factors affecting the way in which the total amount of each product to be produced is decided. This would seem to illustrate that manufacture with respect to the size of production batches is very much controlled by the customer. As mentioned previously a more concise and dependable product forecast would enable the manufacturer to produce his product in more economical batches thus creating a cost saving. The smaller companies tended to indicate that the size of customer order had a great effect upon the length of production run whereas most of the larger companies ranked the production planning department as the major determining effect upon the length of production run.

Most companies stated that if they were able to increase the length of production run the following costs would decrease:

* Note - units in the garment manufacturing sector refers to garment and in the other knitting mill and hosiery sector refers to metres.

distribution cost
 training cost
 raw materials cost
 cost due to lost production time
 set up and change over cost.

Table 5.18 Factors Affecting the Length of Production Run

The factors affecting the length of production run are ranked in order from that having the most affect to that having the least affect. Those factors enclosed in brackets have equal ranking (see question 17 appendix II).

Rank	Garment Manufacture	Hosiery and Other Knitting Mills
1	Size of order	Size of order
2	Labour availability	Raw materials supply
3	Sales department	Production planning
4	Raw materials supply	Sales department
5	Machine capacity	Machine capacity
6	Production planning	Labour availability
7	Seasonal aspects	Condition of machinery
8	Condition of machinery	Transport factors
9	Transport factors	Seasonal aspects

The majority of manufacturers that replied also indicated that an increase in the length of production run would enable them to decrease the price of the final product.

The garment manufacturing category and the hosiery and other knitting mills categories differ in that the garment manufacturing category ranks "seek export markets" as the most common method of increasing production run length whereas the most common method in the hosiery and other knitting mills category is "seek new markets within New Zealand". At the time the respondents filled in the questionnaire our major clothing export market, Australia, was booming, since then the Australian government has place a quota of \$20m of imported clothing on New Zealand⁽³¹⁾. Between June 1975 to June 1976 there was an increase in exports of clothing to Australia of 220%.

Should the same question relating to methods of increasing production run length be asked now I think the order would be slightly altered with respect to "seeking export markets".

Table 5.19 Methods of Increasing the Length of Production Run

The methods by which manufacturers are attempting to increase the length of production run are ranked in order from that method proving the most common to that which is the least common (see question 19 appendix II)

Rank	Garment Manufacture	Hosiery and Other Knitting Mills
1	Seek export markets	New markets in New Zealand
2	New markets in N.Z.	Decrease range of products
3	Decrease range of products	Improve production planning
4	Improve production planning	Seek export markets
5	Advertising and sales promotion	Standardisation of components
6	Standardisation of components	Advertising and sales promotion

"Decreasing the range of products and increasing the quantity of remaining products" ranks relatively highly for both the hosiery and other knitting mills and garment manufacture categories which would seem to indicate that the manufacturers realise a rationalisation in the range of products (along with improved forecasting techniques) will improve the profitability of the company.

N.F. Roberts in his summary of the 1974 Textile Institute conference outlines the following methods as those by which the New Zealand textile and clothing manufacturers could increase the length of production run;

- " i) Manufacture for stock - this approach entails additional costs from interest on capital in stock;
- ii) Reduce the variety of goods offered;

- iii) Co-ordination, Specialisation, Rationalisation etc;
- iv) Export Orders
- v) Import Short Run Products⁽⁹⁾”

Table 5.20 Average Number of Production Runs by Greatest Number of Production Runs

The following table is a frequency table of the average number of production runs of one product against the greatest number of production runs of one product.

Average Greatest	1-5	6-10	11-20	21-30	31-50	51-75	>75	Total
1-5	53(5)							59(6)
6-10	17(2)	17						37(2)
11-20	12(3)	8(5)	10(1)					33(10)
21-30	4	1(1)	4	7(1)				16(2)
31-50	(2)	1	2	1(1)	3(1)			8(4)
51-75	1(1)		1	3(1)	3(1)	9(1)		17(4)
< 75	8(1)	7	2	1		2	2(1)	22(2)
Total	95(14)	3 (6)	19(1)	12(3)	6(2)	11(1)	2(1)	

The data enclosed in brackets is related to the hosiery and other knitting mills category, that not enclosed in brackets is related to the garment manufacturing industry.

The greatest number of production runs of any one product increases significantly with the average number of production runs of any one product for both the garment manufacturing and hosiery and other knitting mill categories. The average number of production runs also increases with a decrease in the average length production run for both industry categories.

Note from Table 5.20 that on the average the majority of companies have less than ten production runs of the one product per year whilst there are a few companies that have in excess of seventy five production runs of one product, a very high figure when looked at in light of the rest of the industry.

Particularly in the hosiery and other knitting mills category where the cost incurred due to set up etc., by so many production runs would be very high.

d) Distribution and Finished Product

Of those companies in the hosiery and other knitting mills category that replied to the questionnaire 61% indicated that they held up to 10% of their finished product for stock whilst of those that replied in the garment manufacturing sector 74% indicated that they held up to 10% of their finished product for stock. A company carrying too much finished product as stock is subjected to additional costs in the form of interest on capital in stock. These interest charges can exceed the savings in unit cost obtained by increasing the production run length. There is therefore a minimum cost batch size which can be calculated from the interest rate, sales forecast of rate of dissipation of stock and knowledge of the variation of unit cost with production run length.⁽³²⁾

Very few manufacturers appear to be employing the use of stock holding to increase the length of production run, some of the reasons given are:

"If we have sufficient time, facilities and raw materials we would utilize it and produce for stock"⁽²⁷⁾

"Never hold finished products stock because of the fashion nature of the industry"⁽¹⁹⁾.

The three most common sources to which the majority of manufacturers in both the garment manufacture and hosiery and other knitting mills categories pass their final product are:

- i) Directly to many different retailers
- ii) Wholesaler
- iii) Export market

The fact that the majority of companies that returned questionnaires indicated that the majority of their final product passes directly to many different retailers, (most of whom are small businesses) could well be a cause for the short production runs experienced.

As mentioned previously many manufacturers will supply to a broad range of customers as a form of insurance to themselves, the replies received to the question relating to this (question 21 appendix II) appear to reinforce this.

Table 5.21 Frequency of Contact with Major Customers

Frequency	Garment Manufacture	Hosiery and other Knitting Mills
Up to once a week	52	5
Every 1-2 weeks	40	12
Every 3-4 weeks	17	2
Once a month	34	2
Less than once a month	54	7

As can be seen from Table 5.21 the majority of garment manufacturers are in contact with their major customers at least once every two weeks and a similar situation exists for those hosiery and other knitting mills that replied to the questionnaire.

"The closer the relationship with the customer the better the service and hence it is easier to give what is wanted and keep a track of faults"⁽³³⁾.

A close relationship with the customer should also allow the manufacturer to gain a better understanding of the market and thus assist him with planning in that he should then have a greater knowledge as to what the trends and behaviour patterns of the market are likely to be, this appears to be happening in that the frequency of contact with the major customer increases significantly with the average production run length.

Analysis shows that the time required for an order of final product to be fulfilled decreases significantly as the frequency of contact with the customer is increased, this would seem to indicate that a closer contact with the major customer(s) enables the manufacturer to better organise his production such that shorter turn around times can be obtained.

Greater communication between the manufacturer and retailer should enable the manufacturer to make a better judgement of the likely demand for his products and what products he is likely to be producing in the future. Following is a rather severe but nevertheless sometimes true comment on customer - manufacturer relations. "Very often it is the customer himself who causes most of the trouble, by not making up his mind until the last minute, and then wanting the job yesterday"⁽³⁴⁾

Table 5.22 Average Time to Fulfil an Order for Final Product

Time	Garment Manufacture	Hosiery and Other Knitting Mills
1 month	44	6
1-2 months	58	8
2-4 months	37	10
4-6 months	36	4
6-8 months	8	1

It can be seen from Table 5.22 that for the garment manufacturing industry in particular the average time to fulfil an order varies considerably, the majority of the companies having an average turn around time less than two months. The turnaround time for the hosiery and other knitting mills tends to be greater than that for the garment manufacturing sector, perhaps this is due to the long production runs, larger companies and increased cost of machine set up etc.

In both the garment manufacturing and hosiery and other knitting mills categories, the majority of companies, if they are unable to fulfil an order will inform the customer and fulfilment of the order is given a high priority. This again appears to indicate the need for a forecasting and production plan that is reliable within the workings of the company. If when a manufacturer cannot fulfil an order he gives that order a high priority this is likely to lead to an interruption of the production flow.

Fragmented production flow will create increased costs with respect to machine set-up, lost production time and having to readjust the programme of production.

5.2.3 Economic Performance and Management Techniques

a) Management Techniques

The management techniques referred to here are those outlined in question 25 (see appendix II) i.e. market research, work study, incentive schemes, feasibility analysis, organisation and methods and value analysis.

Table 5.23 Use of Management Techniques

The data is given as the percentage of companies in the respective categories using the respective management technique.

	Garment Manufacture	Hosiery and Other Knitting Mills
Market research	22.5%	47%
Work study	29.1%	50%
Incentive schemes	56%	69%
Feasibility analysis	16.8%	22%
Organisation and methods	47.5%	62.5%
Value analysis	19.3%	25%

From Table 5.23 it can be seen that the majority of companies that replied in the garment manufacture and hosiery and other knitting mills categories employ the use of incentive schemes and organisation and methods. Referring to incentive schemes following are some of the comments made during discussions with manufacturers:

"it seems to give them that little bit extra to work for"⁽²⁷⁾

"competition certainly increases their work rate"⁽³⁵⁾

Market research is employed mainly by the larger companies, the major purpose of it being the determination of the position of the companies products on the market and how they are progressing in relation to their competitors.

Work study, as with feasibility analysis is mainly practised by the larger companies, many of the smaller companies do not employ it because they consider they cannot afford it.

"The role of work study in the smaller company can be considerable but it has to be prudently applied and short cuts found using the simplest techniques and procedures compared with those practised in large companies, otherwise it may prove too costly or impractical for continued use"⁽³⁶⁾.

The frequent use of management techniques seems to be employed by the larger companies yet they would greatly assist the smaller company with respect to its production flow and sales of final product. The use of management techniques are just as much a way of thinking as they are a formalised technique thus they can have just as much impact on the smaller company as they can on the larger company.

b) Economic Performance

The variables used as the determinants of economic performance are the annual sales turnover and the liquidity ratio.

$$\text{Liquidity ratio} = \frac{\text{Net Profit After Tax}}{\text{Net Current Assets plus Net Fixed Assets}} \quad (37)$$

For both the garment manufacturing and hosiery and other knitting mills category the sales per year increased significantly with the liquidity ratio and the profits increased significantly with sales.

One of the main problems cited in most studies on small manufacturers (the majority of the garment and hosiery and other knitting mills category) is the lack of financial planning;

"financial mismanagement is another major problem with small businesses"⁽²³⁾

"One can, in fact, argue that the sheer vulnerability of the smaller company makes it imperative that disaster avoiding techniques like financial planning should be utilized"⁽³⁸⁾.

"One of the difficulties for the small firm is the higher risk factor means finance is hard to get, especially if control is to be retained"⁽³⁶⁾.

Analysis of the questionnaires returned indicates that as the average production run length increases so to does the annual sales and liquidity ratio. This might seem to reinforce the arguement for an increase in the length of the average production run, the ways in which this may be brought about are many e.g. improved production planning, decrease in the number of products offered and an increase in the efficiency of the production planning technique used.

The annual sales also increase significantly with the number of years a company has been in business, the degree of sophistication of production and the number of employees in the company. This would seem to illustrate greater sales for the larger and more established companies which is as would be expected.

One of the major problems in the garment and knitting manufacturing industries is the seasonal indent selling. Seasonal indent selling doesn't ensure that the company has a continuous flow of revenue⁽¹⁹⁾, this in turn places great pressure on the manufacturer as most small companies in New Zealand are relatively under capitalised as it is⁽³⁾.

c) Marketing

"Production and marketing are the principal functional areas of business. It is true that there exists firms and even industries in which either one assumes a position of over-riding importance, but generally speaking we can regard them both as the twin foundations of modern industry"⁽³⁹⁾.

The majority of the manufacturing companies in New Zealand industry tend to be more production oriented than marketing orientated by virtue of the way in which they developed"⁽¹⁵⁾. The driving force has been the desire and ability to manufacture, rather than efficient business organisation"⁽¹⁵⁾.

I consider the majority of manufactures in the New Zealand garment and knitting industry to be marketing orientated in that they will produce for the customer virtually what he wants but this must be accompanied by a degree of rationalisation in that there should be a more thorough screening process.

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CHAPTER 6

6.0 Conclusions

The following conclusions are drawn from the results of this survey. The section from which each conclusion is drawn is indicated.

1) The woolscouring, woollen milling and other spinning and weaving mills are showing a tendency to the larger company and economies of scale in that between 1960 to 1970 eleven company mergers took place (Section 5.1.1.)

2) In all sections of the New Zealand textile and clothing industry there is a hesitancy to commit production too far into the future for fear of the unknown. Most manufacturers would rather ensure all manufactured goods are made to order, and as orders are often erratic in arriving this often leads to an increased number of production runs of the same product (Sections 5.1.3 and 5.2.2d).

3) An increase in production run length would effect the majority of manufacturers in the following way:

- a) decrease the setup and changeover cost
- b) decrease cost due to lost production time
- c) decrease cost due to wasted raw materials
- d) decrease cost due to distribution
- e) decrease the price of the final product

Thus an increase in average production run length will increase the efficiency of the production unit. (Section 5.1.3 and 5.2.2c).

4) In the garment manufacture and other hosiery and knitting mills categories the greatest factor influencing the design of raw products is overseas samples and magazines closely followed by management or the designers personal opinion. (Section 5.2.2a).

5) The most common method of determining the amount of final product to be produced is to produce to order as the orders are received.

This is one of the factors that causes in many cases a very fragmented production flow and hence short production runs. (Section 5.1.7 and 5.2.2b).

6) The majority of companies in the New Zealand textile and clothing industry take the size of customer order as the major factor affecting the length of a production run. (Section 5.1.7 and 5.2.2c).

7) 80% of hosiery and other knitting mills have an average production run length less than 720 units (metres).

80% of the garment manufacturers have a production run length less than 545 units. (garments) (See section 5.2.1).

8) In general the longer a company has been in business the greater are the following.

- the degree of sophistication of production planning
- the average production run length
- the average number of production runs of the one product
- the number of products produced
- the number of employees
- current and fixed assets and sales
- use of management techniques (section 5.2.1).

9) One of the main reasons given for the high number of products produced by the majority of the smaller companies is the factor of insurance. A company will produce a wide range of products to a wide range of customers to protect itself from sudden death should one of its products or customers fail. (Section 5.2.1)

10) As a company grows it does not tend to specialise or identify one specific section of the market and concentrate on that but rather increase the number of different products produced. (Section 5.2.1).

11) For the garment manufacturing category the degree of sophistication of production planning increases with:

- the number of years the company has been in business
- the number of styles of product produced
- average production run length. (Section 5.2.1).

12) As the size of the company increases the number of production runs per product decreases and accordingly the time between a customer placing an order and receiving that order increases. (Section 5.2.1).

13) For both the garment manufacturing and hosiery and other knitting mills categories the average production run length increases with the size of the company. (Section 5.2.1).

14) As the frequency of communication between a manufacturer and a buyer increases so too does the average production run length while the average number of production runs per product decreases. (Section 5.2.1).

15) For the hosiery and other knitting mills section the frequency of raw materials shortages increases with the following:

- time for raw materials to arrive
- sophistication of production planning. (Section 8.2.2b)

16) In the garment manufacturing and hosiery and other knitting mills categories the minimum production batch the majority of companies would be prepared to consider is very similar to what the company would classify as a short production run (Section 5.2.2c).

17) The sequence of production and size of production batches is very much influenced by the consumer in that it is "the size of customer order" that has the most effect upon the length of production run. The smaller companies being more affected by the size of order than the larger companies when determining the length of production run. (Section 5.2.2c).

18) With the correct data an economic production batch can be calculated taking into account the following variables:

- rate of dissipation of stock
- variation of cost with production run length
- interest rate. (Section 5.2.2d).

19) The majority of manufacturers in the garment manufacture and hosiery and other knitting mills categories pass their final product directly to many different retailers. (Section 5.2.2d).

CHAPTER 7

7.0 Recommendations

Following are the recommendations that have evolved as a result of this study.

1) With the exception of the woolscouring category there needs to be some degree of rationalization of the number of different products offered by most companies. The situation is such in New Zealand that the broad range of products is leading to many inefficiencies in production.

To compete in New Zealand many companies, have to offer a wide range of products, many buyers want something produced solely for themselves, therefore the problem needs to be tackled from the buyer down. Rationalisation of the number of products produced could not occur overnight but would require some form of product feasibility analysis to be carried out on each companies products.

Such a study would require much work and detail the essence of it being that each manufacturer identify what he is good at and fitting this into a total plan for the industry.

2) As a sound base for planning the industry needs a reliable form of sales forecast, both in terms of the demand for each type of product and the industry trend. A more detailed industry sales forecast with respect to trends and production capacities would enable companies to better plan for the future and protect themselves against major catastrophies. Such a sales forecast could be conducted by one of the many industry federations who might also be able to act as consultants to the industry.

Though the textile and clothing industry has a certain amount of uncertainty attached to it reasonably sophisticated sales forecasting would decrease this uncertainty.

3) Because of the relatively short production runs in the New Zealand industry there needs to be close attention paid to the production planning function. Correct production planning can save many dollars with respect to production efficiency.

Many companies by virtue of their size should have some form of formalized production plan (planning boards or charts on view to all supervisory staff) as opposed to producing whatever the customer wants. In putting together such a production plan close attention should be paid to such aspects as economic production batches and production capacity.

Here sophisticated production planning may require a little more time and effort but this is usually far outweighed by the increase in production efficiency.

4) A reduction in the number of samples prepared, especially in the garment manufacturing industry, would greatly decrease the cost and machine downtime associated with this function. As a means of decreasing the amount of sampling more emphasis should be placed on a more thorough screening of ideas and requests.

5) Many of the difficulties encountered in production such as delivery times, late orders and small production quantities, could be overcome by a closer liaison between the manufacturer and the buyer or retailer. Closer liaison should greatly increase the understanding each has of the others operation and how it functions, as well as allowing many of the inefficiencies to be overcome.

6) There needs to be an increased use of various management techniques, namely industrial engineering, market research and production feasibility analysis. The initial cost of an employee or education programme should be far offset by the relative savings made. Many smaller companies may not have the facility for the use of such techniques but the use of a consultant occasionally should increase greatly the production efficiency.

7) Ideally the structure of the industry should be such that the larger companies produce the more stable products (i.e. long production runs with more specialised machinery) and the smaller companies produce the shorter production runs, often the fashion garments. In this way the shorter communication lines and greater flexibility of the small company would be greatly utilized to the industry's advantage.

To implement such an industry structure would require much reorganisation. The incentive for the manufacturer to want to concentrate on a certain range of items may be inaugurated by an industry controlling body.

8) There is in the New Zealand textile and garment industry the need for a great deal of work to be done on economic batch sizes and the variables involved so as to optimise the economies of short production runs. This work could either be carried out within the industry or a research program at a university or similar research institution.

9) The data collected for this survey should be looked at in far more detail and used to get more detailed results on more specific areas. I have identified the main areas that require more thorough attention.

The results from this survey and those following should be studied carefully and used to the industry's advantage. To ensure complete applicability of the results and analysis there will need to be a very close working relationship between the industry and the researchers.

APPENDIX ITHE PRE-QUESTIONNAIRE LETTER

From: "Production Research",
Department of Industrial Management and Engineering,
Massey University,
Private Bag,
PALMERSTON NORTH.

Dear Sir,

A major problem in the New Zealand Textile and Apparel Industry is that of the Short Production Run because of the relatively small market. A company in New Zealand trying to meet the demands of all consumers is faced with the problems of inefficiency and increased costs due to a wide variety of end products.

The Department of Industrial Management and Engineering, Massey University, is at present conducting research into "The Effects of Short Run Production". As a part of this research, you will be receiving within the next few weeks, a questionnaire designed to determine the areas of Textile and Apparel Production which are affected by "Short Run Production".

The results of this questionnaire should identify the areas upon which Manufacturers should concentrate so as to gain full advantage of the positive "Effects of Short Run Production", and indicate the sectors of production in which further research is required.

It will be most appreciated if you would complete the coming questionnaire as the success of the research depends upon your co-operation.

If you have any enquiries or would like more information on the research project, do not hesitate to contact me at the address below.

"Production Research",
Department of Industrial Management and Engineering,
Massey University,
Private Bag,
Palmerston North.

Phone 69-099 or 69-089
Extension 649

Yours faithfully,



D.P. Maxwell
(Postgraduate Student)

APPENDIX IITHE QUESTIONNAIRE AND ACCOMPANYING LETTER

From: "Production Research",
Department of Industrial Management and Engineering,
Massey University,
Private Bag,
PALMERSTON NORTH.

Dear Sir,

Please find enclosed the questionnaire about which I wrote to you a week or two ago.

The broad nature of the research topic "The Effect of Short Run Production" has made it necessary to concentrate the majority of the research on the one industry. The industry chosen "The Textile and Apparel Industry" has been mentioned by both The Textile Institute (1974 Conference "Reducing the Cost of Short Runs") and the Department of Trade and Industry (1969 Holden Report), as being an industry which suffers from the "Effects of Short Run Production".

The main objective of the enclosed questionnaire is to determine those sectors of Textile and Apparel production that are affected by "Short Run Production" and thence to determine areas in which further research should be carried out.

The results of the questionnaire should be of considerable assistance to the industry in New Zealand. The results should identify the areas upon which New Zealand manufacturers should concentrate so as to make the most of the resources we have available yet still be able to meet the many and varied demands of the New Zealand and overseas consumer.

In the formulation of the questionnaire, much enthusiasm and assistance was received from a number of different organizations involved in the Textile and Apparel Industry thus illustrating the importance of the results to the future development of the industry in New Zealand.

Your assistance in filling in the questionnaire would be greatly appreciated. All returns will be treated in the strictest confidence. If there are any aspects of the questionnaire that you cannot understand or feel you need assistance with, do not hesitate to contact me at the address below.

"Production Research",
Department of Industrial Management and Engineering,
Massey University,
Private Bag, Phone 69-099 or 69-089
Palmerston North. Extension 649

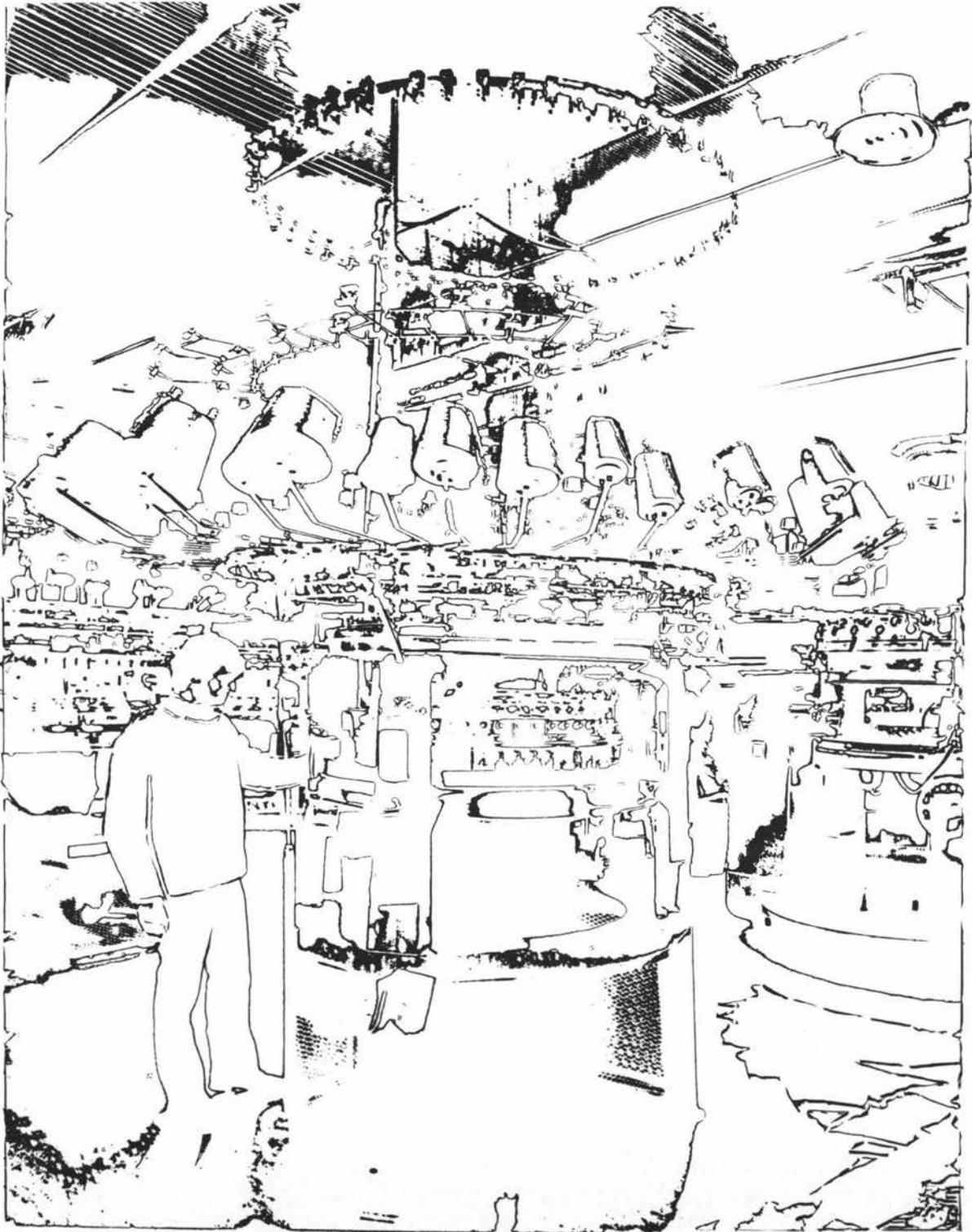
Thank you very much for your assistance.

Yours faithfully,



D.P. Maxwell
(Postgraduate Student)

SHORT RUN PRODUCTION QUESTIONNAIRE



Massey University

THE EFFECTS OF SHORT RUN PRODUCTION

THE TEXTILE AND APPAREL INDUSTRY

For the purposes of this Questionnaire, the Textile and Apparel Industry has been divided into five (5) categories. You will require one copy of the Questionnaire for each category outlined in Question 1.

e.g. If your Company produces knitted fabric and knitted outer wear, you will require two copies of the Questionnaire, one to be filled in for the knitted fabric operation and the other to be filled in for the production of knitted outer wear.

If you have not received sufficient copies of the Questionnaire, please write to the address below requesting more copies.

Production Research,
Department of Industrial Management and Engineering,
Massey University,
Private Bag,
Palmerston North.

It is essential that I receive the completed questionnaire by the 5th November, 1976.

In answering the questionnaire, all you are asked to do is tick the answer box (or boxes) that corresponds to the answer that best represents your Company/Division.

e.g. How many man hours per week are spent in the planning of production?

0 – 5 man hours	<input type="checkbox"/>
6 – 10 man hours	<input type="checkbox"/>
11 – 20 man hours	<input type="checkbox"/>
21 – 40 man hours	<input checked="" type="checkbox"/>
> 40 man hours	<input type="checkbox"/>

If your Company/Division spends 21 – 40 man hours per week on the planning of production, you would have ticked the answer box indicated above.

Should any question not apply to your Company/Division, write N/A alongside the answer boxes.

If while answering the Questionnaire, you feel there are some opinions or comments you would like to offer, then please do so in the blank spaces provided or on a separate leaf of paper.

Following are the definitions of some phrases used in the Questionnaire.

Raw Materials: – all items that are required for production of the final product, including imports.

Production Run: – the number of items, square metres, tonnes etc. of the one style of product produced continuously on the one machine or group of machines.

Different Style of Product: – products that are different in design or require a different technique or method of manufacture. e.g. Womens skirts and womens trousers or knitted fabrics of two different designs.

Production Planning: – determination of the sequence and quantity in which products will be produced, thus enabling the calculation of the delivery date to be made.

Sample: – that which is produced as a trial product, it may not finally reach the market.

1. In which of the following categories would you classify the majority of your Company's/Division's activity?

Note: You will require one copy of the questionnaire for each of the following categories

- Woolscouring
- Woollen Milling
- Other Spinning & Weaving Mills
- Hosiery and Other Knitting Mills
- Garment Manufacture
- Other (Please specify) _____

1	2	3	4
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5		6	
<input type="checkbox"/>	<input type="checkbox"/>		

2. For approximately how many years has the Company's/Division's activities involved it with the category indicated in Question 1.

- 0 - 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- 21 - 30 years
- 31 - 40 years
- More than 40 years

7

3. Is ownership of your Company/Division Public, Private or is it Subsidiary?

- Public
- Private
- Subsidiary

8	9
<input type="checkbox"/>	<input type="checkbox"/>

4. What is the total number of employees in your Company/Division?

- Less than 15
- 16 - 30
- 31 - 50
- 51 - 100
- 101 - 250
- More than 250

10

5. In the past financial year how many different styles of *product did your Company/Division produce?

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 30
- 31 - 50
- 51 - 100
- More than 100 (Please specify approximately) _____

11

* See introduction for definition

6. What proportion of your product(s) fall(s) into each of the following price categories? (Please tick one box for each). Fur coats would be classified as high price items whereas plastic raincoats would be classified as low price items.

	Well Over Half	About Half	Between Half and Quarter	Less Than Quarter	Nil
Low Price	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium Price	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High Price	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12 13 14

7. On the average what percentage of your finished product is produced for stock? (as opposed to being produced for indent)

- 0
- 1 - 5%
- 6 - 10%
- 11 - 20%
- 21 - 30%
- More than 30%

15

8. (a) In what units do you normally measure production output?

- Number of Items
- Square Metres
- Metres
- Kilograms
- Tonnes
- Other (Please specify) _____

16

(b) What do you estimate to be the average length of *production run in your Company/Division? Use the units indicated in (a).

- 1 - 5
- 6 - 25
- 26 - 50
- 51 - 100
- 101 - 250
- 251 - 500
- 501 - 1,000
- 1,001 - 2,000
- More than 2,000 (Please specify) _____

17 18

(c) In your Company/Division what would you classify as a short production* run? (Use the units indicated in (a))

- 1 - 50
- 51 - 100
- 101 - 200
- 201 - 300
- 301 - 500
- More than 500 (Please specify approximately) _____

19

* See introduction for definition

(d) What is the minimum length production* run your Company/Division would be prepared to consider? (Use the units indicated in (a)

Office Use Only

- 1 - 50
- 51 - 100
- 101 - 200
- 201 - 300
- 301 - 500
- More than 500 (Please specify approximately)

20

(e) If the quantity you ticked in (d) was doubled (i.e. the minimum production run length indicated in (d) doubled) approximately by what percentage would the following increase or decrease?

(Two (2) ticks are required for each answer, one to indicate whether there would be an increase or decrease and the other to indicate the category which best represents the size of that increase or decrease)

	Increase	Decrease	No Change	1 - 25%	26 - 50%	51 - 75%	75 - 100%
Set up and changeover cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost due to lost production time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste of raw* materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distribution costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Training costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Price of final product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21 22

23 24

25 26

27 28

29 30

31 32

33 34

9. Which of the following are the major influences in the design of new products? (Tick no more than **three** (3))

- Overseas samples and magazines
- Management or Designers personal opinion
- Consumer Ideas
- No scope for design just given specification by customer
- Facilities and skills available within the Company/Division
- Ideas from the retailer or wholesaler
- Others (Please specify)

35 36 37

10. Approximately what percentage of samples* produced are eventually put on the market?

- 0 - 20%
- 21 - 40%
- 41 - 60%
- 61 - 80%
- 81 - 90%
- 91 - 100%

38

* See introduction for definition

11. Estimate what percentage of total production time (in terms of hours of production) is associated with the production of samples or trial runs?

- 1 - 5%
- 6 - 10%
- 11 - 20%
- 21 - 30%
- More than 30% (Please specify approximately)
- No production time is spent on the production of samples

39

12. Which of the following best describe the method by which your Company/Division determines the amount of each product that is to be produced? (Tick as many as may apply)

- The amount produced is an estimate based on the previous years sales
- Only produce to order
- Produce as much as the Manager, Sales Manager or equivalent thinks will sell
- An indication of sales from the first few orders is obtained and from this the amount to be produced is determined
- Employ mathematical and marketing forecasting techniques the results giving the amount to be produced
- Produce as much as the Production Department is capable of producing
- Produce to meet the Raw Material requirements of another Division/Company
- Others (Please specify) _____

40 41 42 43

44 45 46 47

13. Over the past year on the average how often did your Company/Division experience shortages of Raw* Materials?

- Never
- Only once or twice all year
- Approximately once a month
- Approximately once a week
- All the time

48

14. What is the average time between placing an order for Raw Materials and receiving that order?

- 0 - 2 weeks
- 2 - 4 weeks
- 1 - 2 months
- 3 - 6 months
- 6 - 10 months
- More than 10 months

49

* See introduction for definition

15. Which of the following best describes the method of Production* Planning used in your Company/Division?

A separate Production Planning Department or equivalent

Production Planning is done with the aid of planning boards and/or books and administered by the Manager or Foreman

Production Planning is done solely from the Manager or Foremans knowledge, without the use of planning boards or books

Orders are processed in the sequence they are received therefore there is no need for Production Planning

Other (Please specify) _____

50 51

16. How often is actual production checked and compared against planned production?

More than once daily

Daily

Weekly

Fortnightly

Monthly

Nil

Other (Please specify) _____

52 53

17. Rank three (3) of the following in order of the effect they have on the length of production* run in your Company/Division.

Machine capacity

Sales Department

Production Planning* (economic or convenient batch sizes)

The size of customer order

Condition and age of machinery

Raw materials* supply

Labour availability

Transport factors (including containers)

Seasonal aspects

Other (Please specify) _____

54 55 56 57

18. (a) Estimate the greatest number of production* runs of the same product* style you have had over the past year.

1 - 5

6 - 10

11 - 20

21 - 30

31 - 50

50 - 75

More than 75 (Please specify approximately) _____

58

(b) On the **average** how many production* runs of the same product style occurred in the last year?

- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 30
- 31 - 50
- 50 - 75
- More than 75 (Please specify approximately)

59

19. By which of the following methods is your Company/Division attempting to increase the length of production* run? (Tick as many as may apply)

- Increased standardisation of component parts
- Decrease the number of products but increase the quantity of remaining products
- Seek new markets in New Zealand for the products presently produced
- Seek export markets
- Improvement of production planning, machine loading and scheduling
- Increase advertising and sales promotion
- Other (Please specify) _____
- Company/Division is not attempting to increase the length of production run

60 61 62 63

64 65 66

20. Which of the following forms of Quality Control does your Company/Division engage in? (Tick as many as may apply)

- 100% inspection after production
- Sampling at random intervals during production
- Sampling at regular intervals during production
- Sampling at regular intervals after production
- Sampling at random intervals after production
- Quality Inspection is the operators responsibility
- Continuous inspection during production
- Others (Please specify)

67 68 69 70

71 72 73 74

75 76 77

78 79 80

21. To which of the following does the **majority** of your finished product pass after leaving the factory? (Tick as many as may apply)

- Wholesaler
- Directly to one main retailer
- Directly to two or three different retailers
- Directly to many different retailers
- Export market
- To agents or salesman
- Other manufacturers
- Other (Please specify) _____

NEW CARD

1 2 3 4

5 6 7 8

9 10 11 12

22. Approximately how often do you make contact with your major customer? (i.e. those indicated in Question 21) *Office Use Only*

- Daily to once a week
- Once every 1 to 2 weeks
- Once every 3 to 4 weeks
- Once every month
- Less than once a month

13 14

23. If your Company/Division is unable to fulfil an order for a finished product prior to the given delivery date, which of the following best describes the action your Company/Division would take? (Tick as many as may apply)

- Customer informed that you will be unable to fulfil the order
- Customer informed that you will be unable to fulfil the order until a later date and fulfillment of the order is given a high priority
- Customer informed that you will be unable to fulfill the order until more is produced at a later date
- The customer is informed he cannot have the requested product but you offer a similar product
- Other (Please specify)
- Never experienced shortages of finished product

15 16 17

18 19

24. Currently what is the average turnaround time for an order of a finished product? i.e. from the time the orderer places the order to the time he received it.

- Less than 1 month
- 1 - 2 months
- 2 - 4 months
- 4 - 6 months
- 6 - 8 months
- More than 8 months

20

25. Which of the following management techniques has your Company/Division made use of or is at present using?

	Never Used	Used in the Past	In Use at Present
Market Research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work Study - including Time and Motion Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Employee Incentive Schemes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feasibility Analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organisation and Methods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value Analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21 22

23 24

25 26

27 28

29 30

31 32

33 34

It would help us greatly to have the following information. It is required for statistical purposes only.

Office Use Only

26. The position held in the Company/Division of the respondent.

27. What was the total Company/Division Sales/Turnover at the completion of the financial years shown? Approximations will be sufficient.

1972 \$

1973 \$

1974 \$

1975 \$

1976 \$

28. Approximately what was the Net Profit after Tax, Net Fixed Assets and Net Current Assets for the five years shown below?

	Net Profit after Tax	Net Fixed Assets	Net Current Assets
1972	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
1973	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
1974	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
1975	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
1976	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>

Please state below any comments or ideas you have on the topic "The Effects of Short Run Production" and the Questionnaire you have just completed.

Thank you very much for your assistance. All information in the questionnaire will be treated as highly confidential.

Please return the completed Questionnaire in the attached envelope before the 5th November 1976.

My grateful thanks

D.P. Maxwell
(Postgraduate Student)

35										
□										
36	37	38	39	40	41	42				
43	44	45	46	47	48	49				
50	51	52	53	54	55	56				
57	58	59	60	61	62	63				
64	65	66	67	68	69	70				
71	72	73	74	75	76	77				
78 79 80										
										2

NEW CARD

1 2 3 4										
□ □ □ □										
5	6	7	8	9	10	11				
12	13	14	15	16	17	18				
19	20	21	22	23	24	25				
26	27	28	29	30	31	32				
33	34	35	36	37	38	39				
40	41	42	43	44	45	46				
47	48	49	50	51	52	53				
54	55	56	57	58	59	60				
61	62	63	64	65	66	67				
68	69	70	71	72	73	74				
75 76 77 78 79 80										
										3

NEW CARD

1 2 3 4										
□ □ □ □										
5	6	7	8	9	10	11				
12	13	14	15	16	17	18				
19	20	21	22	23	24	25				
26	27	28	29	30	31	32				
33	34	35	36	37	38	39				

THE FOLLOW-UP AND REMINDER LETTER

From: Production Research,
Department of Industrial Management and Engineering,
Massey University,
Private Bag,
Palmerston North.

Dear Sir,

A few weeks ago, I mailed to you a questionnaire concerning short run production in the Textile and Apparel Industry. For reasons of validity of results, a questionnaire such as that which I sent you is very dependant upon the co-operation of the recipient in returning the completed questionnaire.

At the time of mailing this letter, I have not received a completed questionnaire from your Company and so that analysis of results can get underway I would be most grateful if you would return the completed questionnaire in the very near future. The greater the number of questionnaires returned the more valid will be the results, an analysis of which will be fed back into the industry.

If for any reason you have mislaid the questionnaire or have met with difficulties in filling it in do not hesitate to contact me at the following address:

Production Research,
Department of Industrial Management and Engineering,
Massey University,
Private Bag,
Palmerston North.

Phone 69-099 Extension 649

Yours faithfully,



D.P. Maxwell
(Postgraduate Student)

From: Production Research
Department of Industrial Management and Engineering
Massey University
Private Bag
Palmerston North

Dear Sir/Madam

At the time of mailing this letter I have not received from your Company a completed copy of the questionnaire on short run production and the New Zealand and Textile industry. I urge you to complete and return the questionnaire as the results obtained from it will be fed back into the industry as well as being used for further research.

Short run production, which is due to our relatively small market, is seen as a problem to many New Zealand Textile and Apparel manufacturers. The research at present being undertaken will determine the effects of the short production run and in turn investigate methods of nullifying the ill effects. Information gathered from the questionnaire will be used to determine the situation of the New Zealand Textile and Apparel industry in relation to short run production as well as being used as a base for further research.

I would be most grateful if you would complete and return the questionnaire. Should you have mislaid your copy of the questionnaire or have met with difficulties in filling it in do not hesitate to contact me.

Yours faithfully



D.P. MAXWELL B.Tech (Hons)
Postgraduate Student

APPENDIX IV

THEORETICAL DATA USED FOR VALIDITY TESTS⁽¹⁾

χ^2 Test - based on 1972/73 and 1973/74 figures

(a) Woolscouring

Number of replies = 8
Total number of companies = 28

Table IV.1

	Ownership		Number of Employees			
	Public	Private	6-10	11-20	21-50	> 50
1972/73	4	24	1	6	16	5
1973/74	4	24	1	10	13	4

(b) Woolmilling

Number of replies = 8
Total number of companies = 21

Table IV.2

	Ownership	
	Public	Private
1972/73	14	7
1973/74	14	7

Table IV.3

	Number of Employees						
	0-10	21-50	51-100	101-200	201-300	301-400	> 400
1972/73	3	1	3	6	2	4	4
1973/74	2	1	3	6	2	2	3

(1) Department of Statistics. Statistics of Industrial Production 1973/74 Government Printer, Wellington 1977.

(c) Other Spinning and Weaving Mills

Number of replies = 8

Total number of companies = 25

Table IV.4

	Ownership	
	Public	Private
1972/73	12	13
1973/74	11	13

Table IV.5

	Number of Employees						
	<10	11-20	21-50	51-100	101-200	201-300	> 300
1972/73	6	0	8	3	8	2	2
1973-74	3	2	6	4	7	2	2

(d) Hosiery and Other Knitting Mills

Number of replies = 31

Total number of companies = 84

Table IV.6

	Ownership	
	Public	Private
1972/73	18	63
1973/74	23	58

Table IV.7

	Number of Employees						
	< 6	6-10	11-20	21-50	51-100	101-200	> 200
1972-73	9	6	18	21	13	12	5
1973-74	5	8	17	22	16	11	5

(e) Garment Manufacture

Number of replies = 202

Total number of companies = 637

Table IV.8

	Ownership	
	Public	Private
1972/73	66	576
1973/74	75	552

Table IV.9

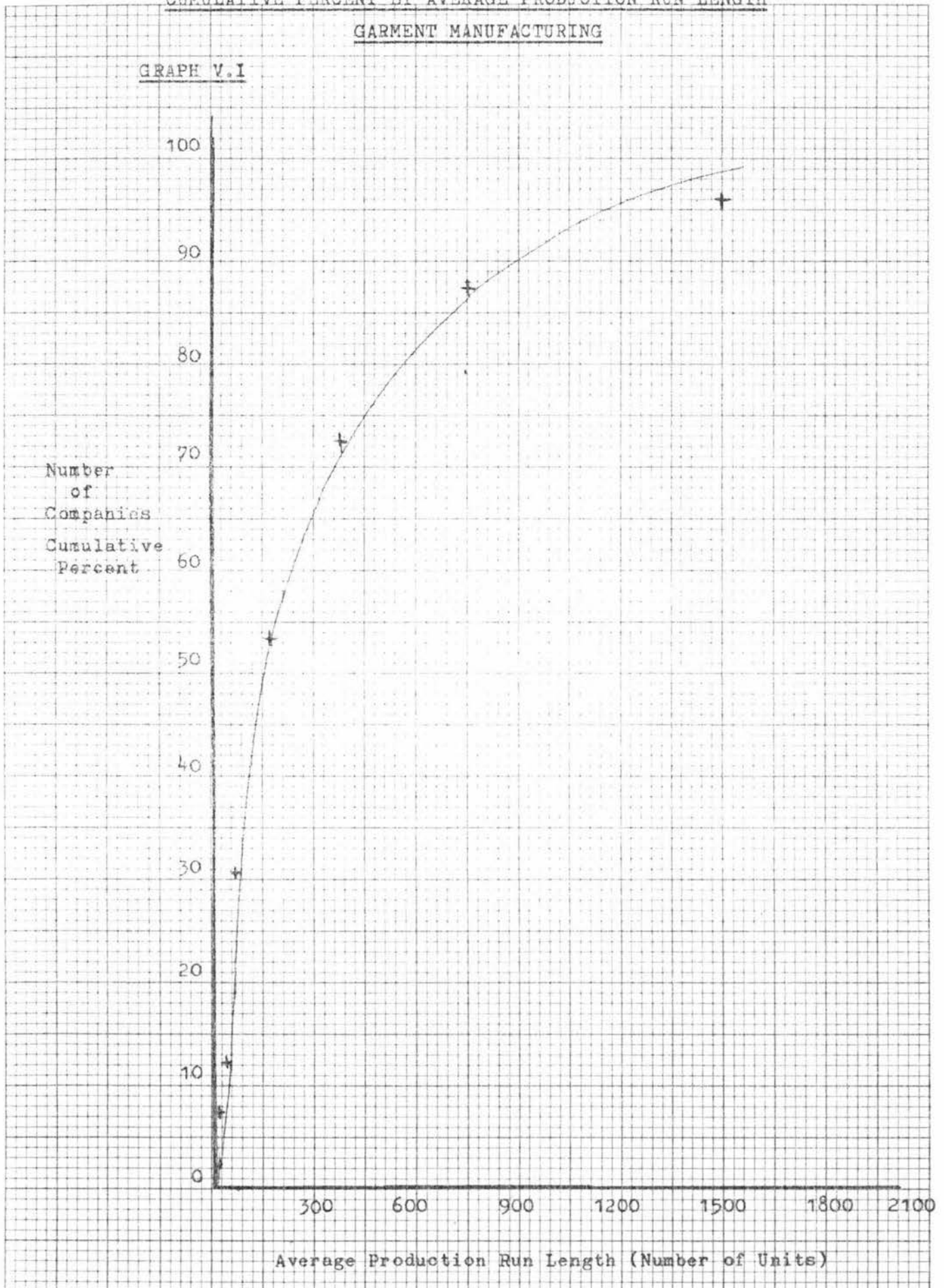
	Number of Employees								
	0-6	6-10	11-20	21-50	51-100	101-200	201-300	301-400	> 400
1972/73	69	105	153	200	82	24	3	2	1
1973/74	80	105	161	184	80	20	3	3	1

QUANTITATIVE DEFINITION OF A SHORT PRODUCTION RUN

CUMULATIVE PERCENT BY AVERAGE PRODUCTION RUN LENGTH

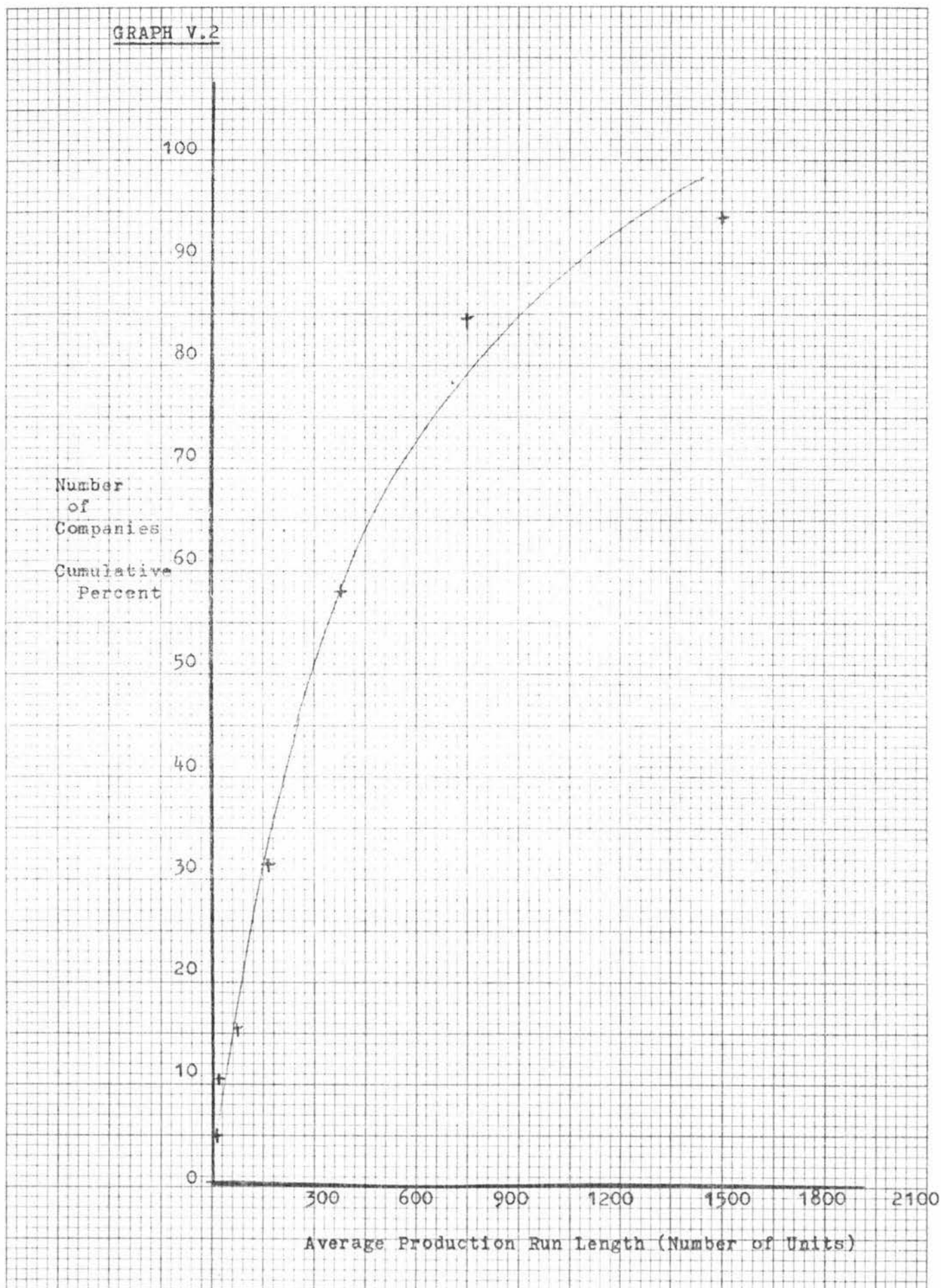
GARMENT MANUFACTURING

GRAPH V.1



OTHER HOSIERY AND KNITTING MILLS CATEGORY

GRAPH V.2



MASSEY UNIVERSITY
COMPUTER UNIT

S P S S - STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES

VERSION 5.09.224

PRINT BACK
RUN NAME
FILE NAME
INPUT MEDIUM
VARIABLE LIST

CONTROL
FREQUENCY ANALYSIS TEST
TEXTFREQ CONTAINS FIRST FREQUENCY ANALYSIS
DISK
CUNO, CATEGY, YEARS, OSHIP, EMPLYE, STYPRO, LOWP, MEDP, HIGHP,
STCKPC, UNITS, AVEPRL, SHTPRL, MINPRL, SETCHC, LSTPIC, RMCOST
DISTNC, TRAINC, PRICE, OTHER, DESIN1 TO DESIN3, PCSAMP
PCTIME, AMTPD1 TO AMTPD8, RMSHRT, TIMERM, PRODPL, PRODCK
RANK1 TO RANK3, GTNOPR, AVNOPR, INCPK1 TO INCPK7
QC1 TO QC6, PASSP1 TO PASSP8, CUNTAC, NILFP1 TO NILFP5
TIMEFP, MKTRES, HKSTUD, INCENT, FLSANY, GANOM, VALANY
OTEK, POSTN, SALE72 TO SALE76, PROF72 TO PROF76
FASS72 TO FASS76, DATREC, CASS72 TO CASS76, PRL1 TO PRL10

OF CASES
INPUT FORMAT

ESTIMATED 500
FIXED (F4,0, F2,0, F1,0, F2,0, 7F1,0, F2,0, 2F1,0, 7F2,0
15F1,0, 2F2,0, X, 3A1, 17F1,0, /4X, 8F1,0, F2,0, 6F1,0, 7F2,0
F1,0, 5F7,0, /4X, 10F7,0, X, F4,0, /4X, 5F7,0, 10A1)

THISS
COMPUTE
COMPUTE
COMPUTE
COMPUTE
RECODE

LIQ72=PROF72/(FASS72+CASS72)
LIQ73=PROF73/(FASS73+CASS73)
LIQ74=PROF74/(FASS74+CASS74)
LIQ75=PROF75/(FASS75+CASS75)
LIQ76=PROF76/(FASS76+CASS76)
RANK1 TO RANK3 ('A'=1) ('B'=2) ('C'=3) ('D'=4) ('E'=5)
('F'=6) ('G'=7) ('H'=8) ('I'=9) ('J'=10) ('L'=0) /
PRL1 TO PRL10 ('V'=1) ('R'=2) ('S'=3) ('T'=4) ('U'=5)
('V'=6) ('W'=7) ('X'=8) ('Y'=9) ('Z'=10) (' '=0) /

RECODE

YEARS (1=2,5) (2=7,5) (3=12,5) (4=17,5) (5=22,5) (6=35) (7=40) /
STYPRO (1=2,5) (2=7,5) (3=12,5) (4=17,5) (5=25) (6=40)
(7=75) (8=100) /
AVEPRL (1=2,5) (2=15) (3=37,5) (4=75) (5=175) (6=375) (7=750)
(8=1500) (9=2000) /
EMPLYE (1=7,5) (2=22,5) (3=40) (4=75) (5=175) (6=250) /
CUNTAC (1=12) (2=3,5) (3=15) (4=1) (5=.5) /
RMSHRT (1=0) (2=1,5) (3=12) (4=52) (5=100) /
TIMERM (1=0,25) (2=.75) (3=1,5) (4=4,5) (5=8) (6=10) /

IF
IF
IF
IF
IF
IF
IF
IF

(NILFP5 EQ 6) NILFP6=6
(LIQ72 LT 0,0) RAT72=1
(LIQ73 LT 0,0) RAT73=1
(LIQ74 LT 0,0) RAT74=1
(LIQ75 LT 0,0) RAT75=1
(LIQ76 LT 0,0) RAT76=1
(LIQ72 EQ 0) RAT72=0
(LIQ73 EQ 0) RAT73=0

MASTER PROGRAM USED TO ANALYSE DATA

APPENDIX VI

FREQUENCY ANALYSIS TEST

06/22/77

IF (LIQ74 EQ 0)RAT74=0
 IF (LIQ75 EQ 0)RAT75=0
 IF (LIQ76 EQ 0)RAT76=0
 IF (SALE72 GT 0 AND LT 10000)TU72=1
 IF (SALE73 GT 0 AND LT 10000)TU73=1
 IF (SALE74 GT 0 AND LT 10000)TU74=1
 IF (SALE75 GT 0 AND LT 10000)TU75=1
 IF (SALE76 GT 0 AND LT 10000)TU76=1
 IF (SALE72 GT 10000 AND LT 50000)TU72=3
 IF (SALE73 GT 10000 AND LT 50000)TU73=3
 IF (SALE74 GT 10000 AND LT 50000)TU74=3
 IF (SALE75 GT 10000 AND LT 50000)TU75=3
 IF (SALE76 GT 10000 AND LT 50000)TU76=3
 IF (SALE72 GT 50000 AND LT 100000)TU72=4
 IF (SALE73 GT 50000 AND LT 100000)TU73=4
 IF (SALE74 GT 50000 AND LT 100000)TU74=4
 IF (SALE75 GT 50000 AND LT 100000)TU75=4
 IF (SALE76 GT 50000 AND LT 100000)TU76=4
 IF (SALE72 GT 100000 AND LT 500000)TU72=5
 IF (SALE73 GT 100000 AND LT 500000)TU73=5
 IF (SALE74 GT 100000 AND LT 500000)TU74=5
 IF (SALE75 GT 100000 AND LT 500000)TU75=5
 IF (SALE76 GT 100000 AND LT 500000)TU76=5
 IF (SALE72 GT 500000 AND LT 750000)TU72=6
 IF (SALE73 GT 500000 AND LT 750000)TU73=6
 IF (SALE74 GT 500000 AND LT 750000)TU74=6
 IF (SALE75 GT 500000 AND LT 750000)TU75=6
 IF (SALE76 GT 500000 AND LT 750000)TU76=6
 IF (SALE72 GT 750000 AND LT 1000000)TU72=7
 IF (SALE73 GT 750000 AND LT 1000000)TU73=7
 IF (SALE74 GT 750000 AND LT 1000000)TU74=7
 IF (SALE75 GT 750000 AND LT 1000000)TU75=7
 IF (SALE76 GT 750000 AND LT 1000000)TU76=7
 IF (SALE72 GT 1000000)TU72=8
 IF (SALE73 GT 1000000)TU73=8
 IF (SALE74 GT 1000000)TU74=8
 IF (SALE75 GT 1000000)TU75=8
 IF (SALE76 GT 1000000)TU76=8

VAR LABELS

CUND, COMPANY NUMBER/
 CATEGORY, INDUSTRY CATEGORY/
 YEARS, YEARS IN INDUSTRY CATEGORY/
 OSHIP, STATE OF COMPANY OWNERSHIP/
 EMPLOYE, TOTAL NUMBER OF EMPLOYEES/
 STYPRO, NUMBER OF DIFFERENT STYLES OF PRODUCT/
 LOWP, PROPORTION OF PRODUCTS LOW PRICED/
 MEDP, PROPORTION OF PRODUCTS MEDIUM PRICED/
 HIGHP, PROPORTION OF PRODUCTS HIGH PRICED/
 STCKPC, % OF FP PRODUCED FOR STUCK/
 UNITS, UNITS IN WHICH MEASURE PRODUCTION/
 AVEPRL, AVERAGE LENGTH PRODUCTION RUN/
 SHIPKL, CLASSIFICATION OF SHORT PRODUCTION RUN/
 MINPRL, MIN PRODUCTION RUN WOULD CONSIDER/
 SETCHC, SETUP & CHANGEOVER COST/
 LSTPTC, COST DUE TO LOST PRODUCTION TIME/

FREQUENCY ANALYSIS TEST

06/22/77

RMCOST, COST DUE TO WASTED RAW MATERIALS/
 DISTNC, CHANGE IN DISTRIBUTION COST/
 TRAINC, CHANGE IN TRAINING COSTS/
 PRICE, CHANGE IN PRICE OF FINAL PRODUCT/
 OTHER, OTHER COST CHANGES/
 PCSAMP, % OF SAMPLES THAT REACH MARKET/
 PCTIME, % OF TIME SPENT ON SAMPLES/
 RMSHRT, FREQ OF RM SHORTAGES/
 TIMERM, AVERAGE TIME FOR RM ORDER TO ARRIVE/
 PRUDPL, PRODUCTION PLANNING METHOD USED/
 PRUDCK, FREQ PRODUCTION CHECKED AGAINST PLANNED/
 GTNOPR, MUST PRODUCTION RUNS OF SAME STYLE/
 AVNOPR, AVERAGE NO PRODUCTION RUNS OF SAME STYLE/
 CONIAC, FREQ OF CONTACT WITH MAJOR CUSTOMERS/
 TIMEFP, TURN AROUND TIME FOR ORDER OF FP/
 MKTRES, USE OF MARKET RESEARCH/
 WKSTUD, USE OF WORK STUDY/
 INCENT, USE OF INCENTIVE SCHEMES/
 FESANY, USE OF FEASIBILITY ANALYSIS/
 QANDM, USE OF ORGANISATION & METHODS/
 VALANY, USE OF VALUE ANALYSIS/
 OTER, USE OF OTHER MANAGEMENT TECHNIQUES/
 POSTN, POSITION OF RESPONDENT/
 SALE72, SALES IN 1972/
 SALE73, SALES IN 1973/
 SALE74, SALES IN 1974/
 SALE75, SALES IN 1975/
 SALE76, SALES IN 1976/
 PRUF72, NET PROFITS AFTER TAX IN 1972/
 PRUF73, NET PROFITS AFTER TAX IN 1973/
 PRUF74, NET PROFITS AFTER TAX IN 1974/
 PRUF75, NET PROFITS AFTER TAX IN 1975/
 PRUF76, NET PROFITS AFTER TAX IN 1976/
 FASS72, NET FIXED ASSETS IN 1972/
 FASS73, NET FIXED ASSETS IN 1973/
 FASS74, NET FIXED ASSETS IN 1974/
 FASS75, NET FIXED ASSETS IN 1975/
 FASS76, NET FIXED ASSETS IN 1976/
 DATREC, DATE QUESTIONNAIRE RECEIVED/
 CASS72, CURRENT ASSETS IN 1972/
 CASS73, CURRENT ASSETS IN 1973/
 CASS74, CURRENT ASSETS IN 1974/
 CASS75, CURRENT ASSETS IN 1975/
 CASS76, CURRENT ASSETS IN 1976/
 RAT72, 1972 PROFIT RATIO PROFIT:TOTAL ASSETS /
 RAT73, 1973 PROFIT RATIO PROFIT:TOTAL ASSETS /
 RAT74, 1974 PROFIT RATIO PROFIT:TOTAL ASSETS /
 RAT75, 1975 PROFIT RATIO PROFIT:TOTAL ASSETS /
 RAT76, 1976 PROFIT RATIO PROFIT:TOTAL ASSETS /
 DESIN1 TO DESIN3, INFLUENCE ON DESIGN OF NEW PRODUCT/
 AMTP01 TO AMTP08, METHOD OF DECIDING AMOUNT TO BE PRODUCED/
 INCPR1 TO INCPR7, HOW ATTEMPT INCREASE RUN LENGTH/
 QC1 TO QC8, TYPE OF QC USED/
 PASSP1 TO PASSP8, WHERE MAJORITY OF PRODUCT GOES/

VALUE LABELS

NILFP1 TO NILFP6 HOW HANDLE SHORTAGES/
 PRL1 TO PRL10 EFFECT ON RUN LENGTH UNRANKED/
 CATEGORY (1) SCOURING (2) MILLING (3) SPINNING & WEAVING
 (4) HOISERY & KNITTING (5) GARMENTS (6) OTHER/
 YEARS (1) 0-5 YRS (2) 6-10 YRS (3) 11-15 YRS (4) 16-20 YRS (5) 21-30 YRS
 (6) 31-40 YRS (7) GREATER 40 YRS/
 OSHIP (1) PUBLIC (2) PRIVATE (3) SUBSID (12) PUB PRI (13) PUB SUB
 (23) PRI SUB/
 EMPLYE (1) SMALLER THAN 15 (2) 16-30 (3) 31-50 (4) 51-100 (5) 101-250
 (6) GREATER THAN 250/
 STYPRO (1) 1-5 (2) 6-10 (3) 11-15 (4) 16-20 (5) 21-30 (6) 31-50
 (7) 51-100 (8) GREATER THAN 100/
 LDWP (1) WEL OVER 1-2 (2) APROX 1-2 (3) 1-2, 1-4 (4) LES THAN 1-4
 (5) NIL/
 MEDP (1) WEL OVER 1-2 (2) APROX 1-2 (3) 1-2, 1-4 (4) LES THAN 1-4
 (5) NIL/
 HIGHP (1) WEL OVER 1-2 (2) APROX 1-2 (3) 1-2, 1-4 (4) LES THAN 1-4
 (5) NIL/
 STCKPC (1) 0 (2) 1-5% (3) 6-10% (4) 11-20% (5) 21-30%
 (6) GREATER THAN 30%/
 UNITS (1) NUMB OF UNITS (2) SQUARE METRES (3) METRES (4) KILOGRAM
 (5) TONNES (6) OTHER/
 AVEPRL (1) 1-5 (2) 6-25 (3) 26-50 (4) >1-100 (5) 101-250 (6) 251-500
 (7) 501-1000 (8) 1001-2000 (9) IN EXCESS OF 2000/
 SHTPRL (1) 1-50 (2) 51-100 (3) 101-200 (4) 201-300 (5) 301-500
 (6) IN EXCESS OF 500/
 MINPRL (1) 1-50 (2) 51-100 (3) 101-200 (4) 201-300 (5) 301-500
 (6) IN EXCESS OF 500/
 SETCHC (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 LSTPTC (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 RMGOST (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 DISTNC (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 TRAINC (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 PRICE (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 OTHER (14) INCREASE 1-25% (15) INCREASE 26-50% (16) INCREASE 51-75%
 (17) INCREASE 76-100% (24) DECREASE 1-25% (25) DECREASE 26-50%
 (26) DECREASE 51-75% (27) DECREASE 76-100% (30) NO CHANG/
 DESIN1 TO DESIN3 (1) SAMPLES & MAGS (2) MGT ETC OPINION
 (3) CONSUMER IDEAS (4) GIVEN SPEC (5) SKILLS AVAIL
 (6) RETAILER IDEAS (7) OTHER/
 PCSAMP (1) 0-20% (2) 21-40% (3) 41-60%
 (4) 61-80% (5) 81-90% (6) 91-100%

PCTIME (1)1-5% (2)6-10% (3)11-20% (4)21-30% (5)GREATER THAN 30%
 (6)NO TIME SAMPLES/

AMTPD1 TO AMTPD8 (1)EST PREV SALES (2)PROD TO ORDER
 (3)INITIATIVE OF MGT (4)IDEA 1ST ORDERS (5)CASTING TECHNIQ
 (6)PRODUCE CAPACITY (7)RM FOR ANOTHER (8)OTHERS/

TIMERM (1)0-2WKS (2)2-4WKS (3)1-2MTHS (4)3-6MTHS (5)6-10MTHS
 (6)GREATER 10 MTHS/

RMSHRT (1)NEVER (2)1-2 PER YR (3)APROX 1 PER MTH
 (4)APROX 1 PER WK (5)ALL THE TIME/

PRDPL (1)SEPERATE PP DEPT (2)PLANNING BDS BKS (3)MANAGERS KNOWL
 (4)PRD SEW ARRIVE (5)OTHER/

PRUDCK (1)GREATER 1 A DAY (2)DAILY (3)WEEKLY (4)FORTNHTY
 (5)MONTHLY (6)NIL (7)OTHER/

GINOPR (1)1-5 (2)6-10 (3)11-20 (4)21-30 (5)31-50 (6)50-75
 (7)GREATER THAN 75/

AVHOPR (1)1-5 (2)6-10 (3)11-20 (4)21-30 (5)31-50 (6)51-75
 (7)GREATER THAN 75/

INCPB1 TO INCPK7 (1)SPECIALISATION OF PARTS (2)DEC WD OF PRODUCTS
 (3)NEW MKTS IN NZ (4)EXPORT MARKETS (5)PRODUCTION PLANNING
 (6)ADVTG & PROMOTN (7)OTHER (8)NOT INC PRL/

QC1 TO QC8 (1)100% INS (2)RANDOM DURING P (3)REGULAR DURING P
 (4)REGULAR AFTER P (5)RANDOM AFTER P (6)OPERATOR RESPNS
 (7)CONT INS DURING P (8)OTHER/

PASSP1 TO PASSP8 (1)WSALER (2)ONE MAIN RETAILER
 (3)COUPLE RETAILER (4)MANY DIF RETAILER (5)EXPORT MARKET
 (6)AGENT OR SALESMAN (7)OTHER MGFERS (8)OTHER/

CONTAC (1)DAILY TO 1 PR WK (2)1-2WKS (3)3-4WKS (4)ONCE PER MTH
 (5)LES ONCL PER MTH/

NILFP1 TO NILFP6 (1)UNABLE FIL ORDR (2)FIL ORDR LATER
 (3)FIL ORDR MORE (4)OFFER SIMILAR (5)OTHER (6)SHORTAGE NEVER/
 TIMEFP (1)LES ONCE PER MTH (2)1-2MTH (3)2-4MTH (4)4-6MTH
 (5)6-8MTH (6)MORE 8 MTHS/

MKTRES (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

WKSTUD (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

INCENT (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

FESANY (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

DANDH (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

VALANY (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

OTER (10)NEVER USED (20)USED IN PAST (30)PRESENT IN USE
 (23)USE PAST & PRESENT/

POSTN (0)NOT GIVE (1)JIV MGR (2)MANAGING DIRECTR (3)FOREMAN
 (4)PRODUCTN MANAGER (5)ACCNTANT SECRETRY (6)MANAGER/
 PRL1 TO PRL10 (1)MACHINE CAPACITY (2)SALES DEPT
 (3)PRODUCTN PLANNING (4)SIZE OF ORDER (5)CONDITN MACHINRY
 (6)RM SUPPLY (7)LABOUR AVAILBTY (8)TRANSPRT FACTORS
 (9)SEASONAL ASPECTS (10)OTHER/

RANK1 TO RANK3 (1)MACHINE CAPACITY (2)SALES DEPT
 (3)PRODUCTN PLANNING (4)SIZE OF ORDER (5)CONDITN MACHINRY

(6)RM SUPPLY (7)LABOUR AVAILABLE (8)TRANSPORT FACTORS
 (9)SEASONAL ASPECTS (10)OTHER/
 TU72 TO TU76 (1)\$0-9999 (3)\$10000-49999

(4)\$50000-99999 (5)\$100000-499999 (6)\$500000-749999
 (7)\$750000-999999 (8)GT \$1000000

ASSIGN MISSING
 MISSING VALUES

LIQ72, LIQ73, LIQ74, LIQ75, LIQ76 (U)/RAT72 TO RAT76 (U)
 CUNO(-0)/CATEGORY(-0)/YEARS(-0)/USHIP(-0)/STYPRD(-0)/EMPLYE(-0)/
 AVLPRC(-0)/SHTPRC(-0)/MTHPRC(-0)/SETCHC(-0)/
 LSTPTC(-0)/RMCUST(-0)/DISTNC(-0)/TRAINC(-0)/
 PRICE(-0)/UTHER(-0)/
 PCSAMP(-0)/PCTIME(-0)/TIMERM(-0)/AMTPD1 TO AMTPD8(-0)/
 PRUDPL(-0)/PROUCK(-0)/RANK1 TO RANK3(-0)/AVNOPR(-0)/
 QC1 TO QC8(-0)/

MISSING VALUES

PASSP1 TO PASSP8(-0)/CONTAC(-0)/
 NILFP1 TO NILFP6(-0)/TIMEFP(-0)/MKIRES(-0)/WKSTUD(-0)/
 INLCNT(-0)/FEESANY(-0)/DANDM(-0)/VALANY(-0)/
 UTER(-0)/PUSTNC(-0)/SALE72 TO SALE76(-0)/
 PRUF72 TO PRUF76(-0)/PASS72 TO PASS76(-0)/
 DATREC(-0)/CASS72 TO CASS76(-0)/PRL1 TO PRL10(-0)/

MISSING VALUES
 REGRESSION

RMSHRC(-0)/GTJUPRC(-0)/
 TO72 TO TO76(-0)/
 VARIABLES=AVEPRL,EMPLYE,CONTAC/
 REGRESSION=AVEPRL WITH EMPLYE,CONTAC(1)/

OPTIONS
 STATISTICS

2
 2

READ INPUT DATA

AFTER READING 31 CASES FROM SUBFILE TEXTFR, END OF FILE WAS ENCOUNTERED ON LOGICAL UNIT 7
 END OF DATA INPUT, READ COUNT =31 DATA ERROR COUNT = 0.