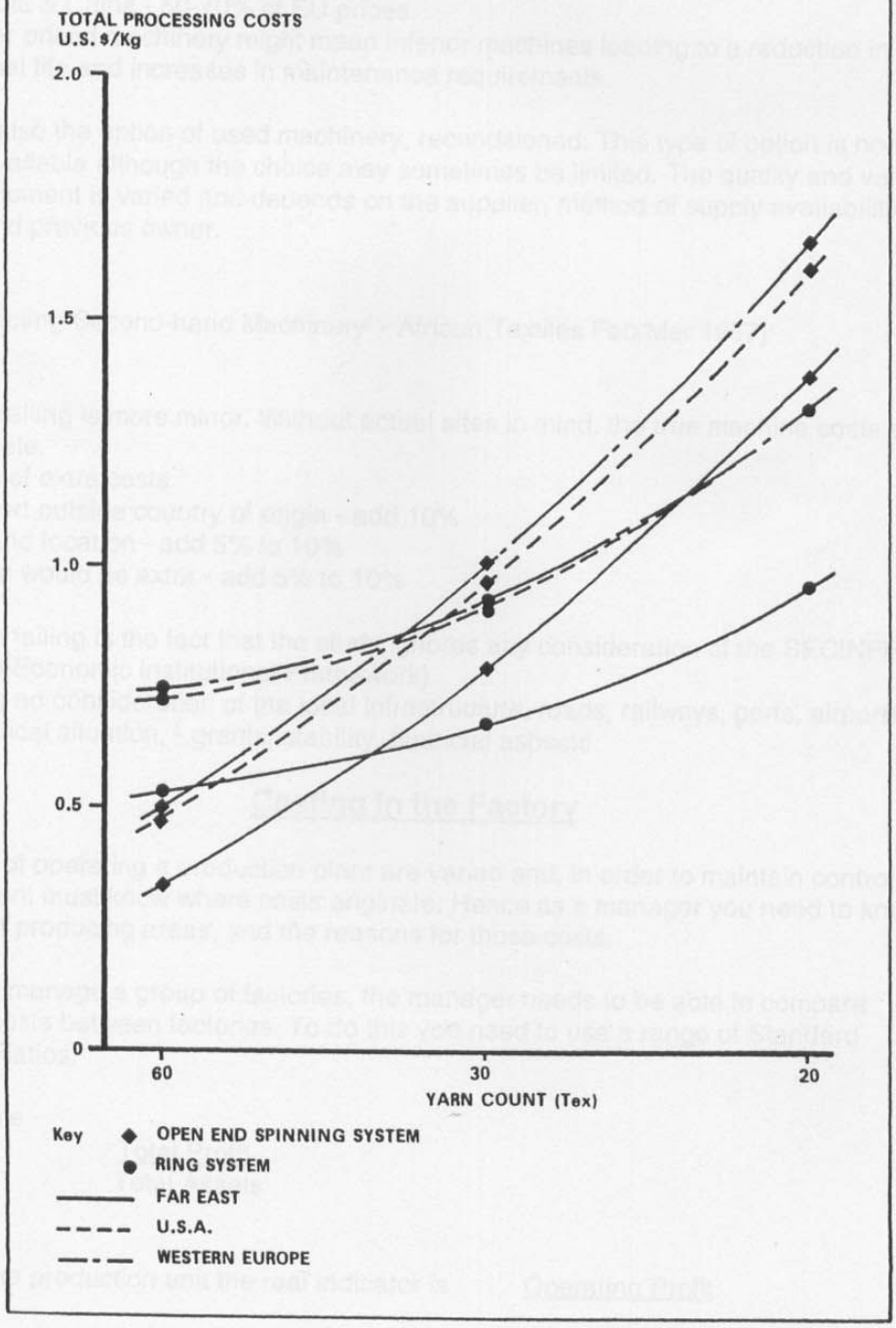
The full study also examined an open-end spinning alternative.

Figure 8

TOTAL PROCESSING COSTS - in 3 economic areas

RING SPINNING SYSTEM - v - OPEN END SPINNING SYSTEM

100% CARDED COTTON WEAVING YARNS



Failings of the study

The first failing was totally understandable, the study was produced by a major machinery manufacturer. The study was limited to technology available for purchase from that company, it did not consider any alternative technologies

The second failing follows from the first. As a Western European manufacturer, machine prices were high. Hence the capital required for the investment was high also.
Other sources were available:

Eastern Europe - lower prices
Japan - lower prices at that time
India & China - 50-70% of EU prices.

This lower priced machinery might mean inferior machines leading to a reduction in the operational life and increases in maintenance requirements.

There is also the option of used machinery, reconditioned. This type of option is normally always available although the choice may sometimes be limited. The quality and value of used equipment is varied and depends on the supplier, method of supply availability of spares and previous owner.

(see 'Selecting Second-hand Machinery' - African Textiles Feb/Mar 1987)

The third failing is more minor. Without actual sites in mind, the true machine costs are not complete.
Examples of extra costs
for transport outside country of origin - add 10%
for an inland location - add 5% to 10%
installation would be extra - add 5% to 10%

The fourth failing is the fact that the study ignores any consideration of the SECINFRA (the Socio-Economic Institutional Framework)
There was no consideration of the local infrastructure, roads, railways, ports, airports or the political situation, - grants, stability, financial aspects. There was also no inclusion of other costs, water, other energy costs coal, gas, oil.

Costing in the Factory

The costs of operating a production plant are varied and, in order to maintain control, management must know where costs originate. Hence as a manager you need to know all the cost producing areas, and the reasons for those costs.

In order to manage a group of factories, the manager needs to be able to compare standard costs between factories. To do this you need to use a range of Standard Financial Ratios.

For example

$$\frac{\text{Total Profit}}{\text{Total Assets}}$$

For a simple production unit the real indicator is $\frac{\text{Operating Profit}}{\text{Operating Assets}}$

Note -

For more varied factories a figure for asset utilisation is useful

$$\frac{\text{Value added}}{\text{Operating Assets}}$$

Operating assets include, of course, both fixed assets and current assets.

It may be useful, particularly for labour intensive operations to consider a measure of the effectiveness of production employees.

$$\frac{\text{Value Added}}{\text{No. of Production Employees}}$$

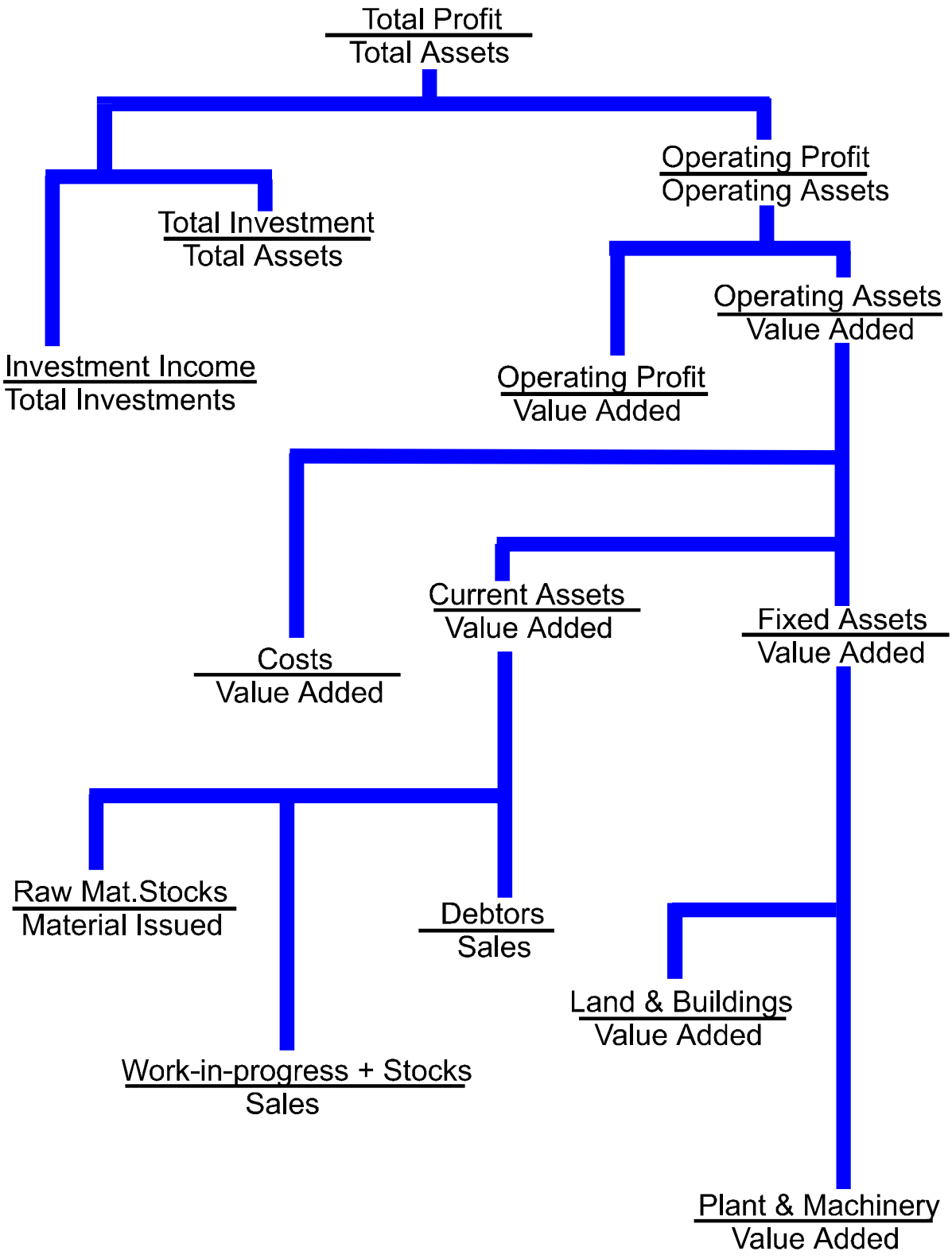
Note -

Any large firm will use a wide range of financial ratios, as seen in the Pyramid of Financial Ratios.

There is a great deal of work involved in assembling the figures to produce the ratios. Until the widespread use of computers, managers would be using weeks, or even months old information.

Nowadays, managers have immediate access to a wide range of information and there is little excuse for errors.

Pyramid of Financial Ratios



Costs and Costing

From all the information above, for the choice of technology, the most important aspects are the costs of the processes.

The following is an example of the likely costs of an established production unit using traditional modern equipment.

Cost	**Example %**
Direct labour	36.5
Indirect labour charges	9.8
Maintenance	10.9
Packing & packaging & accessories	0.9
Steam power & light	7.6
Personnel	1.3
Depreciation of plant & machinery	10.4
Occupation charges	1.0
Bank & loan interest	-
Administration	4.1
Selling & Distribution	1.9

Why are the figures as they are??? - Discuss

What do these figures tell us about the costs of the operations?

Cost Centres and their Identification

In an analysis of costs the first step is the choice of cost centres. This involves breaking down the factory into departments and/or individual processes, e.g. carding, spinning, winding etc.

Following the identification of the cost centres, the costs may be analysed and split between the cost centres. e.g. power costs may be assigned proportionate to the usage of each centre.

This split of costs is satisfactory for the simple assessment of product costing but to measure the performance over a period, or over different factories and sites, it is necessary to use standard costing.

Standard costings must allow for all necessary activities including cleaning, maintenance, checking/inspection. However, it must be remembered that standard costs are only standard for particular sets of parameters, e.g. the quality of the raw material.

Standard costs for any single area of production will include all costs that can be attributed or estimated including :

energy for operation - power
energy for conditions - power, steam, coal, oil
labour costs
rates and rents etc.

These costs may be split in various ways, by space, by value added etc. The cost is then allocated to the product, or to the product process if applicable, depending on the process and the options.

e.g. if yarn is both used for the next process and is also sold as is, then costs up to the yarn stage are necessary information.

Standard costs are necessary for the valuation of work-in-progress, and also as the basis of financial accounts in computerised systems, i.e. the value of product at any stage of completion may be calculated by the use of standard costs.

Comparison of Cost Areas for Spinning

Any study of the economics of spinning must consider the choice of spinning method. There are a wide variety of possible spinning methods, however not all methods produce the same properties in the product and hence in many cases the product alone will determine the spinning method. Where there are options available, the economics of the spinning method must be considered.

The linear density, the count or tex, of the product will normally be a major determinant of the spinning method. For example, in Western Europe, rotor spun yarns are more economic up to 16s cotton count, although a large amount of 20s count is spun on rotor machines.
What is this in tex?

Above 16 to 20 count, ring spinning is generally the more economic method.
The costs incurred by the processing method, will be different and may need to be split in different ways as line of processes may be different.

Area of Cost	**Cost as % of Total Cost**	
	Rotors	Rings

Energy	14	10
Direct Labour	19	51
Spare Parts	12	5
Building	8	6
Machine Costs	44	26
Other	3	2
Total	100	100

Looking at the costs above - a variety of differences can be seen.
The figures are examples only and do not represent actual costs.

Discuss the differences and the reasons for the variations.

In a low labour-cost country, the balance will swing towards ring spinning. The economic barrier for rotor spinning will move more to the coarse-yarn end of the market.

Finer yarns require more labour and machinery because:

Raw Material Considerations in Costs

Raw material considerations depend on the access to the materials and the quality. For natural fibres the fibre fineness and length will determine the product limits. If raw material is local then the product choice is limited. The other aspect of raw material is the waste content, or the cleanliness.

There may also be special considerations, such as an excess of waste fibre.
Ring spinning systems normally require a raw material which contains at least 50% new bale cotton, and ideally a much greater percentage.
Why is this??

Rotor spinning systems need only 20% new bale cotton for waste spinning, but operate better with higher percentages.
In the past, in developing countries, the indigenous cotton (local) was often of low quality, short staple and with a high waste content - e.g. India. More recently some countries have improved their cotton seed and the crop, to produce longer staple fibre. In addition, more developing countries are producing man-made fibres themselves.

Ref - 'Innovation in Textile Restructuring & Production Modes: The Indian Experience' by Radhakrishnan, Iyer & Garde - in World Textiles: Investment Innovation Invention - 1985 338.47677.TEX

Spinning Costs Around the World

In order to make any real comparisons of costs for a particular process around the world, it is necessary to have a idea of the relative levels of costs for different types of inputs.

Conversion Costs (using a factory spinning cotton of average count 20's)

Actual costs as in 1988 (Accurate costs for UK factories are difficult to access)

Type of Cost	**Cost (in p per kg)**
Direct labour	47
Indirect labour	27
Variable expenses	36
Fixed expenses	14
Depreciation	8
Total Conversion Cost	132 p/kg

(Figures for an operating site in south Lancashire U.K.)

To appreciate the importance of the costs, it is necessary to know some facts about the factory which these figures came from. The factory is a long established production unit of a large multinational company. It is housed in a multi-storey cotton mill, in a town well known for textile production.

The machines used are a mixture of traditional modern and modern. Small amounts of investment are taking place in replacement of machines, and many machines are fully depreciated.

With this in mind, the factory lies somewhere in the middle of the labour intensive and capital intensive scale, neither one nor the other.

What is the most noticeable point which may be seen from the figures?

This figure will obviously be a useful guide when assessing the costs of processing abroad - it does not however show how the costs for a new factory would split.

Costs Around the World – Another Study

A wide-ranging study carried out in 1985/86 gives cost comparisons for the basic production costs in a range of countries. The figures cover spinning and weaving.
The countries covered were Brazil, Germany, India, Japan, Korea and the USA.
Ref. - International Production Cost Comparison - 1986 - by the International Textile Machinery Manufacturers Federation (ITMF).

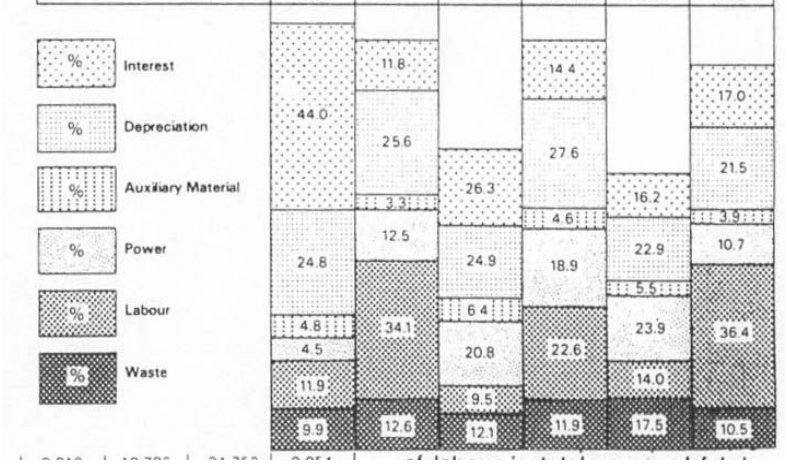
Ref. - Summary of figures may be found in Australasian Textiles - May/June 1986

The spinning and weaving cost tables are shown below.

AUSTRALASIAN TEXTILES. 1986 - MAY/JUNE

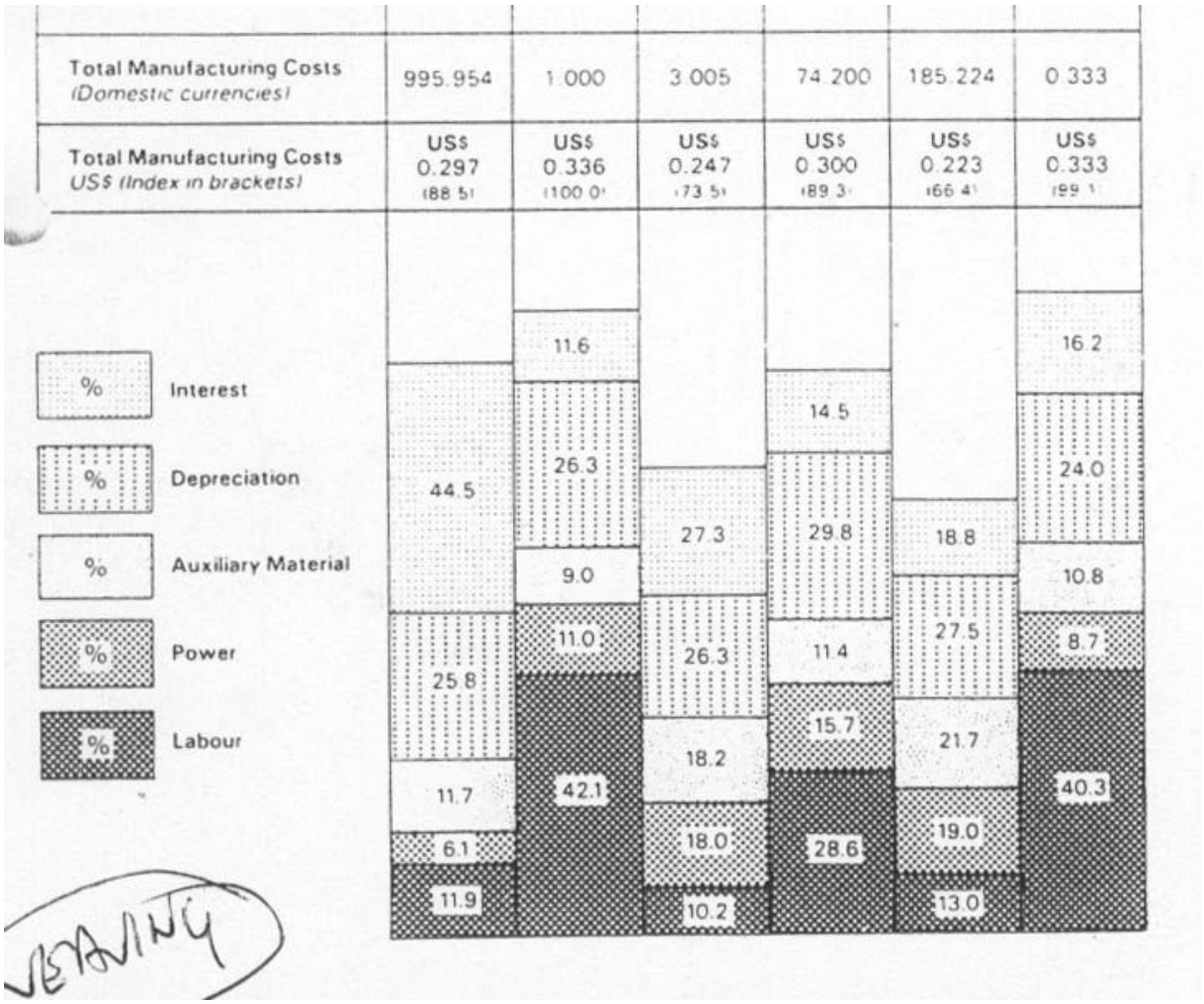
SPINNING

Cost Element	Brazil Crs.	Germany DM	India Rs	Japan Y	Korea W	U.S.A. $
Waste	342.6380	0.3727	1.0451	28.0367	95.2713	0.0970
Labour	410.3080	1.0075	0.8143	53.2855	76.0572	0.3368
Power	155.1720	0.3695	1.7902	44.4079	129.8367	0.0988
Auxiliary Material	166.9640	0.0962	0.5537	10.8351	30.1698	0.0358
Depreciation	854.9200	0.7553	2.1379	64.9708	124.6752	0.1992
Interest	1,513.7980	0.3507	2.2636	33.8200	88.7445	0.1576
Total Manufacturing Costs (Domestic currencies)	3,443.8000	2.9519	8.6048	235.3560	544.7547	0.9252
Total Manufacturing Costs US$ (Index in brackets)	US$ 1.028 (103.6)	US$ 0.9922 (100.0)	US$ 0.7067 (71.2)	US$ 0.9522 (96.0)	US$ 0.6544 (66.0)	US$ 0.9252 (93.2)



Points of note -
Brazil - Interest payments
Labour costs - India v USA
Power costs - Brazil v Korea

These costs are interesting, but we also need to know the relative costs between processes. The total 74p per Kg, can be calculated for each of the processes, to give a breakdown of the costs by process.



Breakdown of Costs in the UK - by Process

Typical costs as at 1988 (using a factory spinning cotton of average count 20 Tex)
Operating Site - Lancashire U.K

Process	Cost (in pence/kg)	% of cost
Opening (mixing and blowing)	2	2.7
Carding	19	25.7
Spinning (Ring)	28	37.8
Winding	17	23.0
General	8	10.8
Total Labour Cost (direct & indirect)	74 p/kg	100%

This is a simplified listing, the complete breakdown of costs will show all sections and processes, and the actual costs of each.

Economics of Weaving

From previous figures it can be seen that the cost of weaving machinery is by far the greatest machinery cost in the production of fabrics.

The actual weaving process cost is also one of the highest proportions of the fabric production cost, hence it is obvious that any changes in weaving costs will be immediately reflected in the fabric costs.

Although the weaving section includes other costs, weaving preparation etc., the greatest cost is weaving itself. Any examination of costs will therefore concentrate on this area. In order to do this, it is necessary to establish the actual activities performed in the weaving department which affect the costs.

The activities include:

- replacement of beam
- tying in of warp
- replacement of weft package
- doffing of cloth
- repair of weft breaks/faults
- repair of warp breaks/faults
- cloth inspection
- plus other jobs dependent on changes of product.

The actual economics of the weaving process will depend on two major factors:

1. the technology of the machines, weft insertion method and speed;

2. the level of automation of the activities.

1. The technology of the machines

The main factor here is the method of weft insertion which, to a large extent, determines the speed of operation of the machines. The method of weft insertion itself may be determined by the product.
Can you think of any examples of this?

Weft insertion methods include shuttle looms, air jets, projectile, water jets, rapiers and also multiphase machines. Obviously all methods have their own optimum and maximum speeds, however the speeds must be considered in relation to the width of the fabric and the ability to weave multiple widths. (see section on Alternative Technologies in Weaving)

Multi-width weaving, weaving two or even three lengths of cloth side by side on the same machine, reduces the optimum operating speed of the machine by a significant factor, but also decreases the efficiency to a small extent.
Why do multi-width looms run slower than single fabric width looms?

When identifying the ideal production system for a particular fabric, close scrutiny is needed to assess all the factors. These factors include:

cost of machine
number of fabric widths
type of fabric
number of colours
hours worked per week
waste levels
any particular requirement, e.g. selvedge

Ref. - Comparative Costs of Shuttleless Weaving - R.Grills - Textile Month - July 1986
(this includes some cost breakdowns - but these are now a little out-of-date)
Ref. - Automatic & Non-Automatic Looms in the Wool Textile Industry - Miller - WIRA Publication No.210 - Dec 1957 (This is old but is an interesting study looking at two different levels of technology.)

2. The level of automation of the activities

This returns to the two basic costs capital costs verses labour costs.
A high level of automation will require substantial extra capital input. To balance these extra costs there are certain savings to be made:

- reduced labour requirement - wage costs reduced as weaver can run more machines
- improved quality
- increased production - as stopped time is reduced - less machine interference
- reduced number of machines required
- reduced space required, smaller factory?

On the down side, there is likely to be a higher requirement for energy, increased automation requires extra power to drive it.

What is the future of automation in Weaving?

Most looms are now fitted with large or self replenishing weft systems, either cone fed or unifil.

Tying-in of warp is automatic

Warp end-break detectors are the norm.

Weft end-break detectors are now more common.

There is little to be seen in patents or exhibitions which will greatly increase the automation in weaving, apart from automatic cleaning systems and machine-based management information systems.

Real needs are weft-end repair and warp-end repair systems - not available yet in reliable form.

This means that improvements in automation of weaving is limited to ancillary activities, including:

- use of large beams
- use of large cloth rolls
- mechanical handling.

Problem - these are features most useful in long-run operations.

The increased automation in the area affects not only the costs - but also the levels of costs relative to each other.

Actual Weaving Costs - (as a percentage of total conversion cost)

	Modern Conventional Mill		**Fully Automated Factory**
Depreciation	35.6		49.3
Interest	15.7		21.7
Wages	34.5		12.3
Power	6.5	10.3	
Space	6.0		4.9
Spares	1.2		1.2
Reject Cloth	0.5		0.3
Total	100%		100%

Comments??

Automation, of course, is not limited to the manufacturing area. There are increasing numbers of areas where new technology has automated and supported jobs, increasing efficiency and reducing labour costs.
How many areas can you identify?

Examination of Cost Factors

For any vertically-established fabric-producing unit, the possibility of cutting costs is always very important. Cost cutting must be considered across the whole of the operations.

The following examples give an overview of an attempt by one fabric manufacturer to analyse their costs and to examine any alternatives in their production procedures and practices.
The study was very wide ranging and considered both short and long term possibilities, and as such is a useful example of the possible use of alternative technologies.

The study was entitled :
"A Method of Examining the Possibilities of Producing Woven Cloth at a Lower Cost"

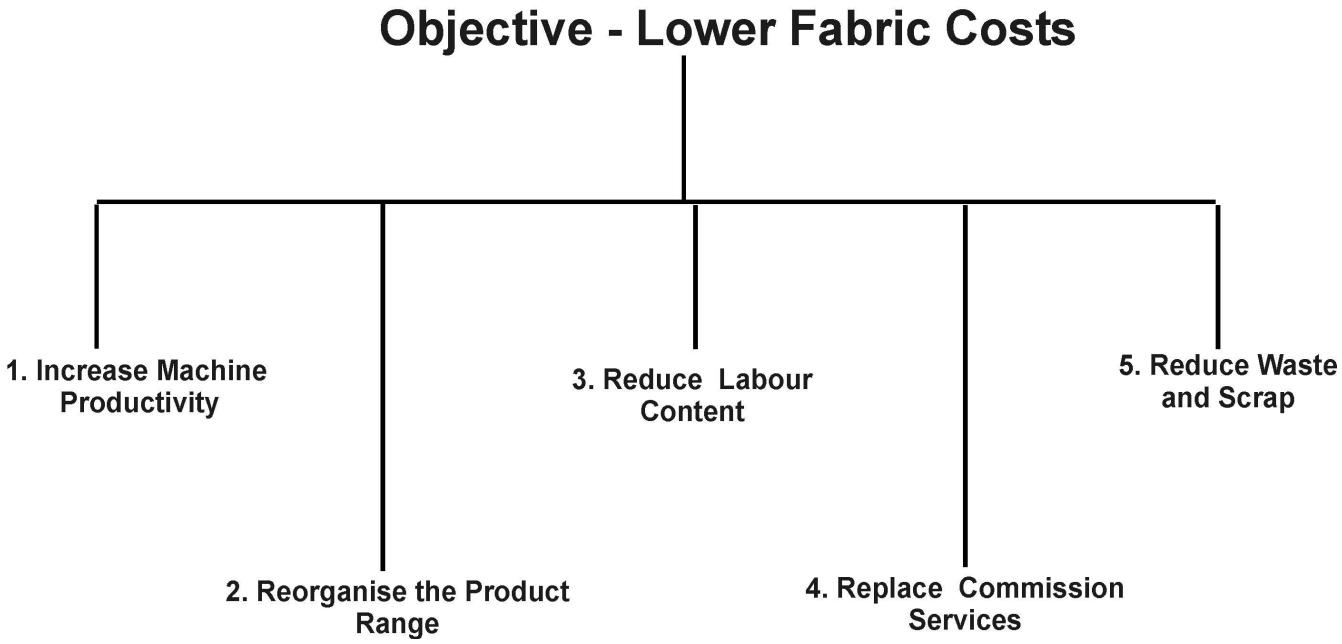
The following example (broken into simple areas over the next six pages) shows only a range of options available to a particular company at a particular time.

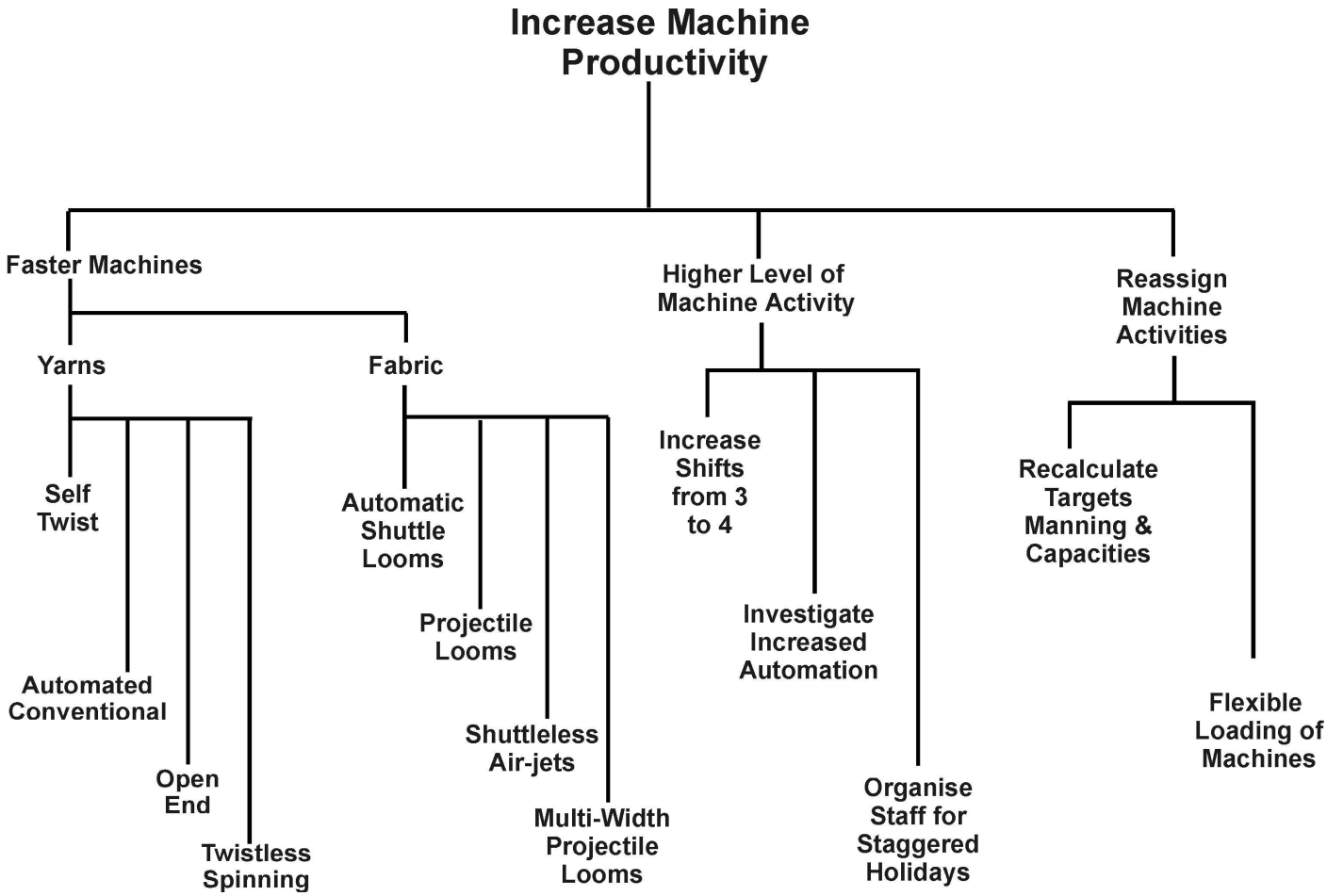
No two studies will ever be the same.

After the listing process is completed, the decision-making process may begin.

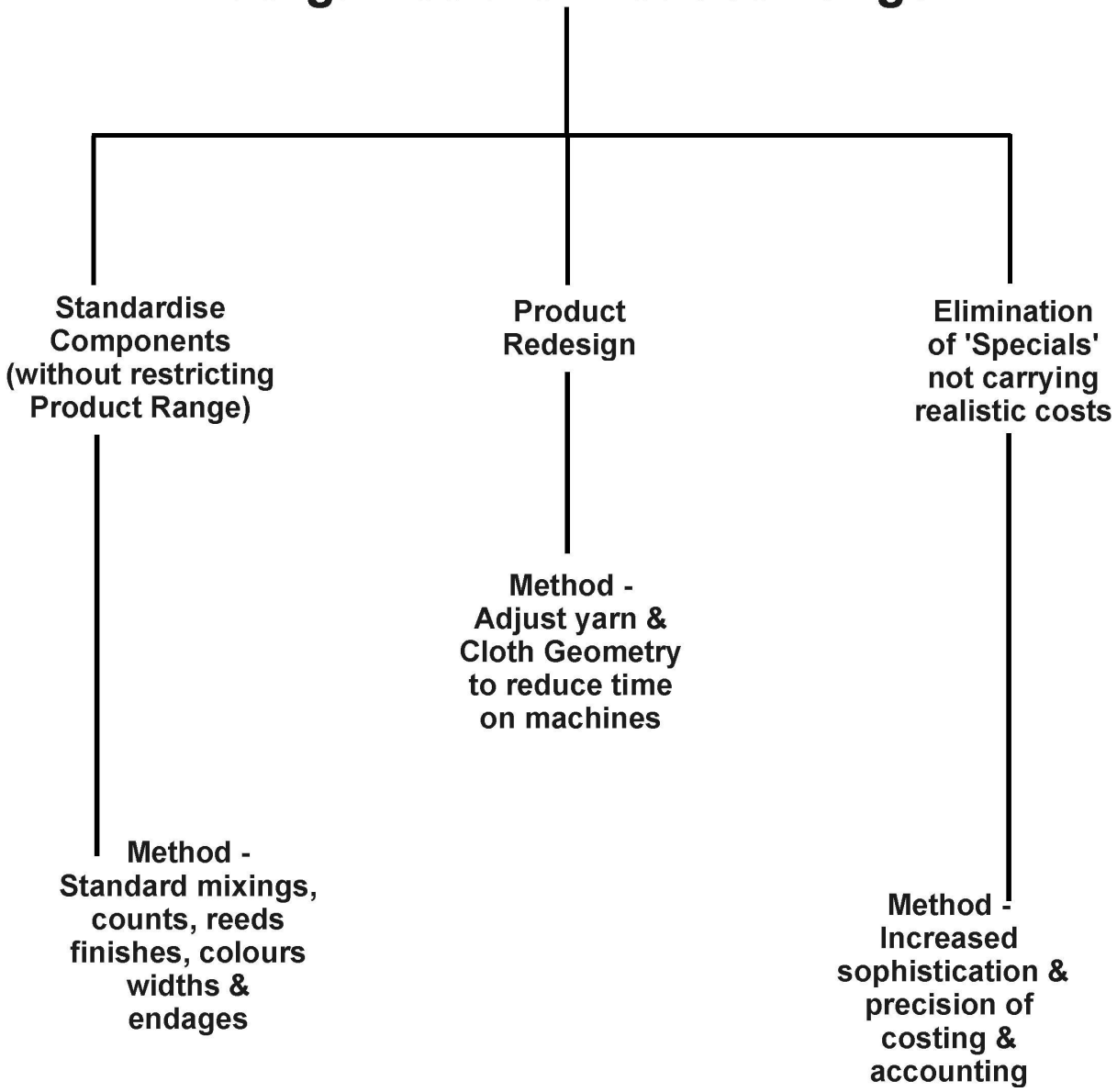
Note - any real study would need the financial information for each option to be included.

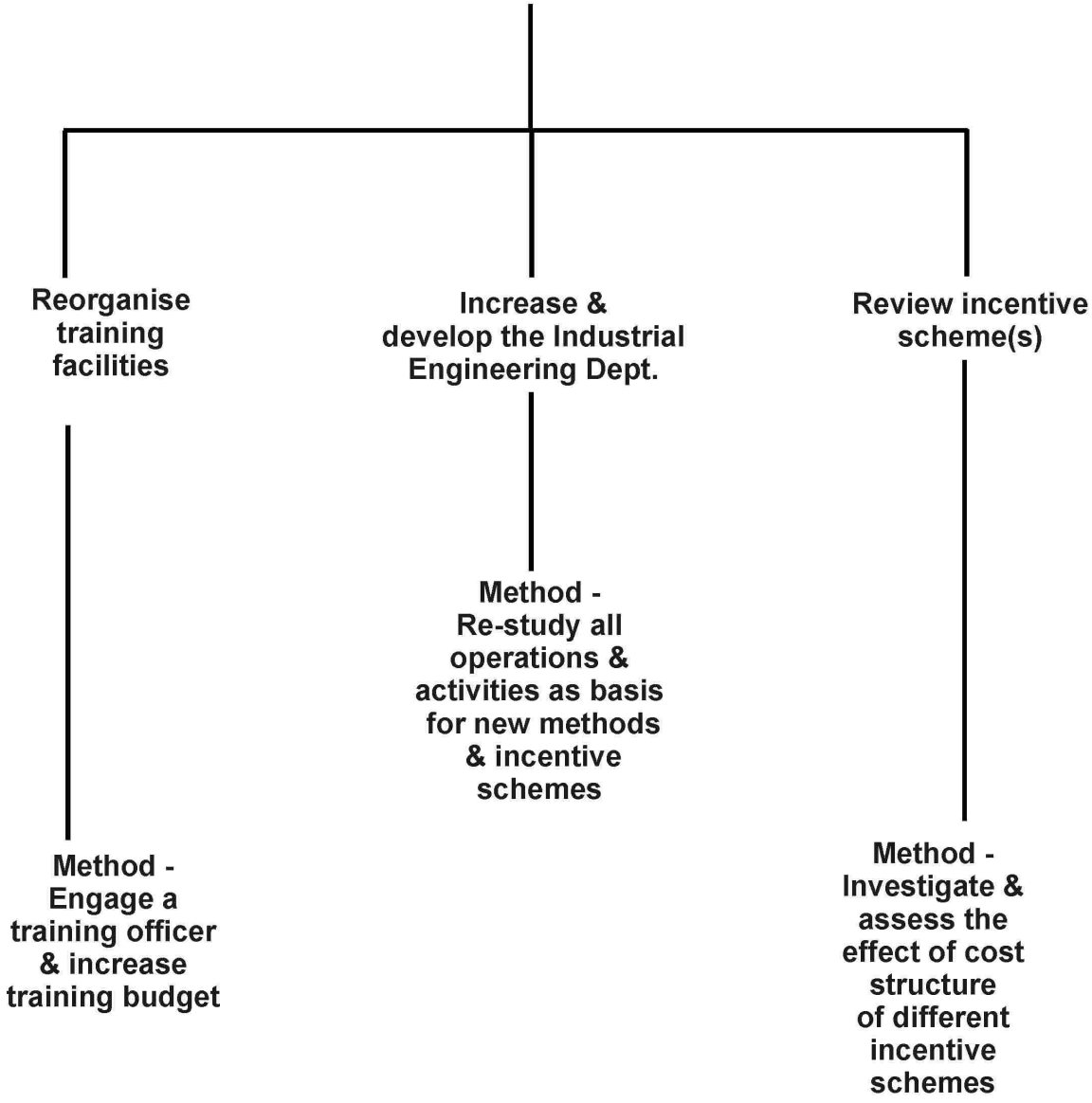
A Method of Examining the Possibilities of Producing Woven Cloth at a Lower Cost



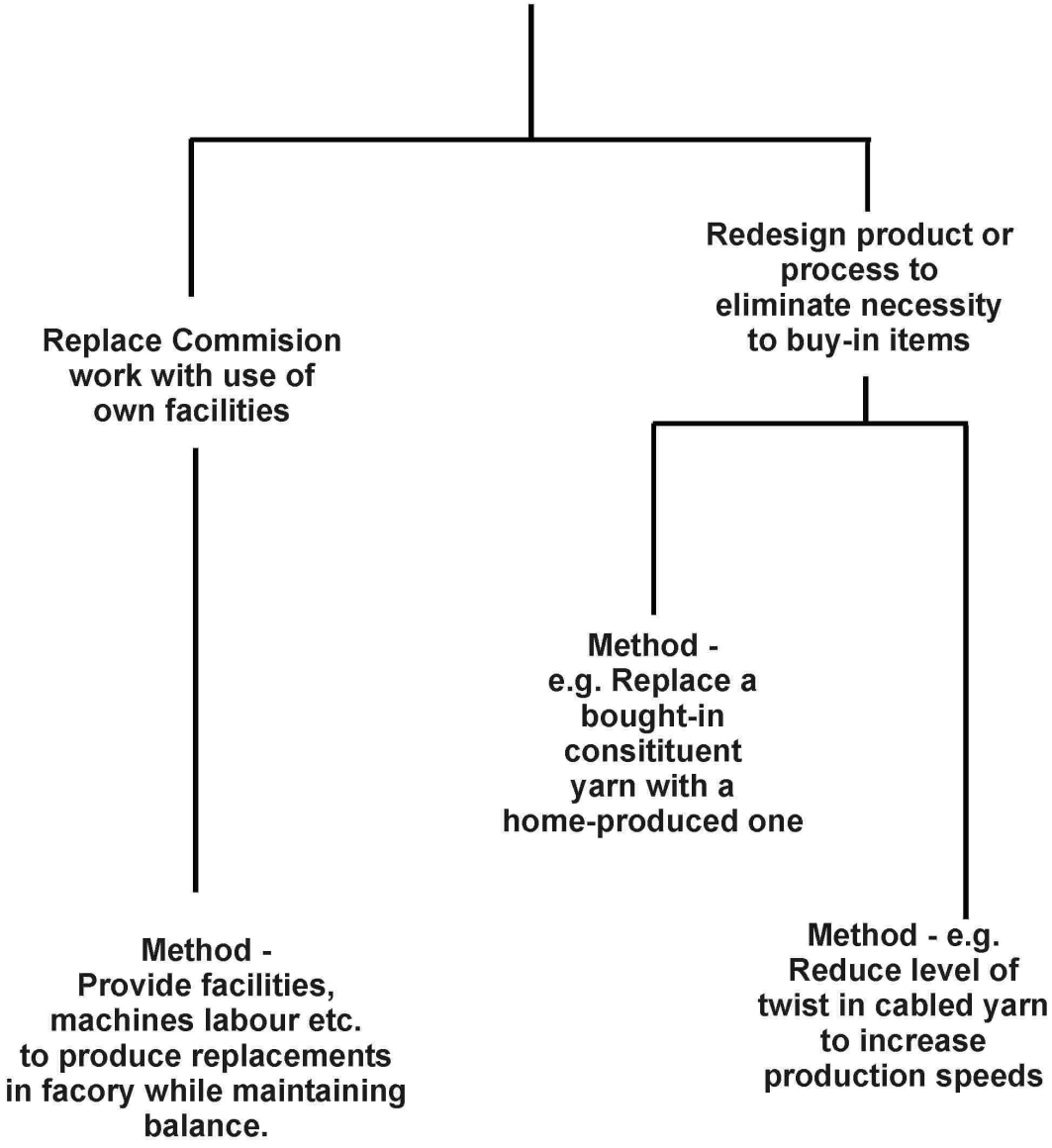

Increase Machine Productivity
Faster Machines
Yarns
Fabric
Higher Level of Machine Activity
Reassign Machine Activities
Self Twist
Automated Conventional
Open End
Twistless Spinning
Automatic Shuttle Looms
Projectile Looms
Shuttleless Air-jets
Multi-Width Projectile Looms
Increase Shifts from 3 to 4
Investigate Increased Automation
Organise Staff for Staggered Holidays
Recalculate Targets Manning & Capacities
Flexible Loading of Machines

Reorganise the Product Range

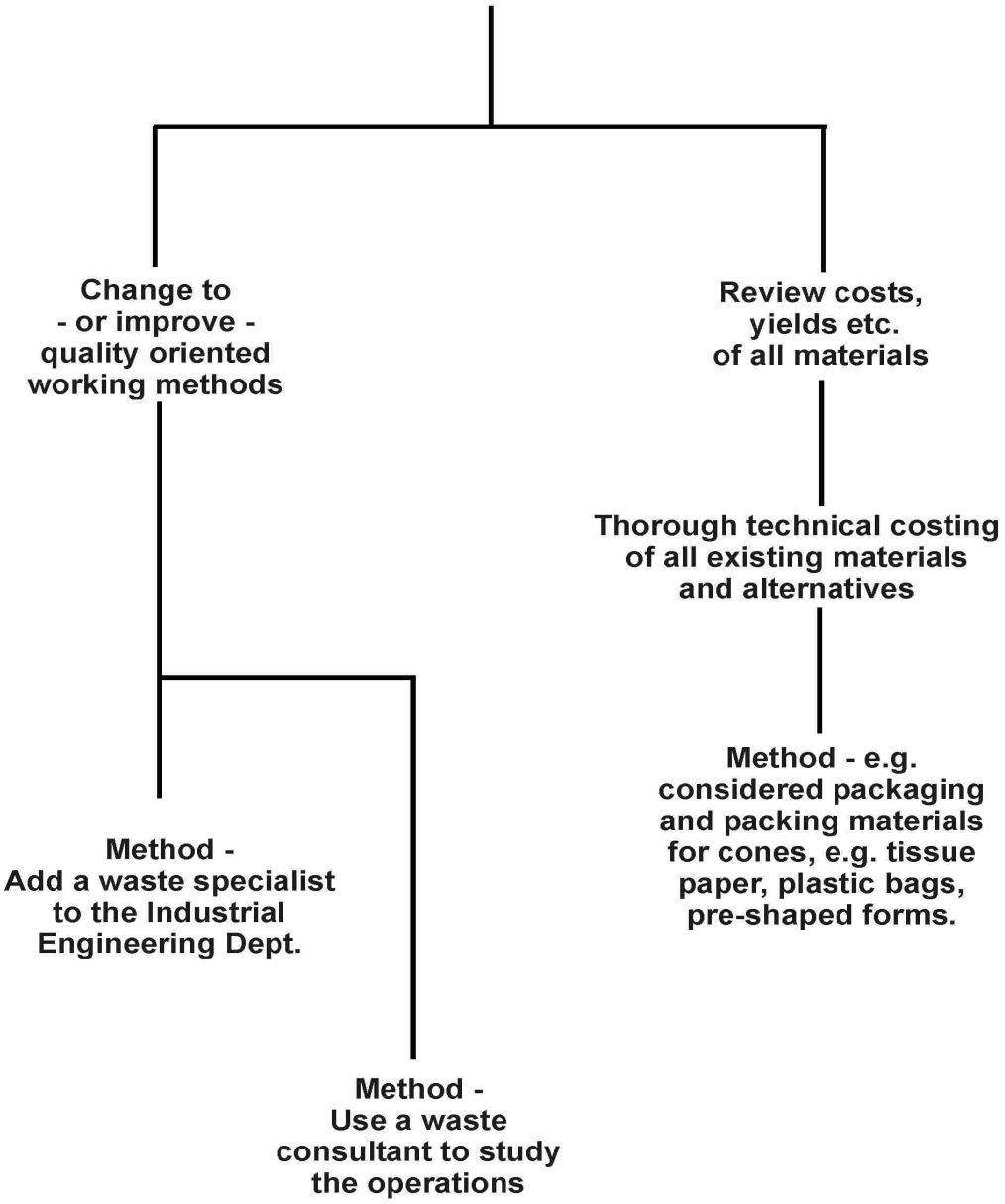



Reduction of Specific Labour Content
Reorganise training facilities
Increase & develop the Industrial Engineering Dept.
Review incentive scheme(s)
Method - Engage a training officer & increase training budget
Method - Re-study all operations & activities as basis for new methods & incentive schemes
Method - Investigate & assess the effect of cost structure of different incentive schemes

Replacement of Commission Services



Reduction of Waste & Scrap



Examination of Actual Costs in Textile Processing

When we come to this stage, we need to examine the extent of the operation to be planned.
Where are the ancillary operations to be performed?

Where is the company management based?

Before these decisions can be made, it is necessary to look at the wider range of production costs and to examine the costs in different areas..

Using a simple example of the production costs of a cotton shirt/blouse the basic production costs might be:

Breakdown of Processing Costs in the Production of a Cotton Shirt/Blouse

Cost Percentages for a High Wage Area and a Low Wage Area

Process	High Wage Area	Low Wage Area
Spinning	22.7	20.0
Weaving	17.2	11.4
Dyeing & Finishing	9.9	6.8
Making-up	50.2	22.4
Total Conversion Cost	100%	60.6%

Figures given are based on a typical Western European country
and a typical low wage area in South-east Asia

Note that - as expected, the major savings in cost in a low-wage area are in the labour-intensive operations. The breakdown can be seen to approximate to earlier figures.

For a full production operation we really need to analyse the other costs also. These include the management costs.

Breakdown of Costs in the Production of a Cotton Shirt

Cost Percentages for High Wage and Low Wage Areas

Cost Area	High Wage Area (HWA)	Low Wage Area (LWA)	LWA as a % of TC of HWA
Raw Material	17.8	22.5	16.1
Labour	40.9	17.8	12.7
Energy	4.6	10.1	7.3
Manufacturing O/Hs	11.0	12.1	8.6
Depreciation	5.9	5.6	4.0
Total Manufactrg Costs -	**80.2**	**68.1**	**48.7**
Financial Costs	6.0	14.4	10.3
Selling & Gen. Admin	13.8	17.5	12.5
Total Costs (TC)	**100%**	**100%**	**71.5%**

The figures represent the costs for a vertical operation, include no profit figures or transport charges. They are more representative of the total costs of making and selling the shirt/blouse.

Any Comments?