NESC REPORT NO. 43

PRODUCTIVITY AND MANAGEMENT

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NATIONAL ECONOMIC AND SOCIAL COUNCIL

Productivity and Management

No. 43

NATIONAL ECONOMIC AND SOCIAL COUNCIL
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PART I

THE COUNCIL'S COMMENTS ON "PRODUCTIVITY AND MANAGEMENT"

1 Introduction

1 The Council has referred to the importance of increased productivity in a number of earlier reports. In its comments on the Green Paper of 1976, the Council stated that:

> ". . . At present, productivity (in the sense of output per person employed) is lower in Ireland in almost all economic activities than in any other EEC country. The potential for increases in productivity are therefore very great. The proposals in the Green Paper . . . fall short of what is needed to raise productivity in Ireland nearer to European levels in comparable activities. . . ."[1]

The Council has already published a study on the implications of the revised population projections for jobs and living standards. That study, which related to 1974 and updated earlier work, was published as part of NESC Report No. 35.[2] The study compared Irish productivity (and living standards) with those in other European countries. At best, the comparisons merely gave a rough indication of the differences between Irish productivity and that of other countries. However, the broad conclusion that emerged was:

> "If productivity could be raised towards European levels, and if the growing population could be employed, the associated rate of economic growth in Ireland could be higher than in any other EEC country. The potential is there: the problem is to identify (and do) what needs to be done to realise it."[3]

[1] NESC, *Comments on Economic and Social Development, 1976-1980*, Report No. 35, July 1977, paragraph 45.

[2] *Population and Employment Projections 1986—A Reassessment*, NESC, No. 35, October 1977 (Part C). The earlier work was: *Jobs and Living Standards: Projections and Implications*, NESC, No. 7, June 1975.

[3] NESC, Report No. 35, page 16.

2 With this potential in mind the Council, in July 1977, commissioned a study from Mr Howard Greer and Mr Eddie Molloy, who at that time were both at the Irish Management Institute. This study would identify the steps that management might take to realise the potential for improvement in productivity. The broad terms of reference of this study were as follows:—

(i) to define productivity, and to consider the determinants of productivity;

(ii) to assess how productivity could be raised, both at the level of the firm and at the level of the industry;

(iii) to consider the barriers to increases in productivity which had been highlighted in recent survey work;

(iv) to make proposals for action which would lead to greater productivity.

II The Consultants' Study

3 Chapter 2 of the consultants' study deals with the definition of productivity. The consultants list some misconceptions which exist on the subject, among which are the following: that productivity applies only to firms which employ manual workers, that increased productivity is equivalent to a scheme for reduction in costs, and that improvements in productivity necessitate redundancies. The Chapter raises some fundamental problems which arise when attempts are made to measure productivity. The consultants conclude that no single index of productivity is universally applicable; a range of indicators should be used by firms. The consultants say that:

". . . the absence of quantitative studies of productivity by many companies remains striking. The very limited use of inter-firm comparison studies in this country shows a lack of concern for levels of productivity."

It appears to the consultants that productivity is rarely discussed by firms outside the context of labour productivity. For firms who wish to make comparisons of their productivity levels with those of other firms, a method is described in the Appendix.

4 Among the most important determinants of productivity (discussed in Chapter 3) are the following: size of the market, economies of large-scale production, new technology, capital investment, the influence of management and of management systems. Market size is important, since it affects the rate of output and the length of production runs. There is a link between capital formation and new technology, since capital formation is the principal way in which new technology is absorbed in an industry. Management has an impact on productivity—through information and control systems, for example. But "the psychological and social strategy whereby change is brought about is, in itself, perhaps the single most important influence on productivity change."

5 The core of the consultants' study is in Chapter 4. This outlines the strategies and the management techniques through which productivity can be increased. These methods are applicable at the level of the firm. The choice of appropriate strategy is concerned with issues such as the type of organisation (whether it should be centralised or decentralised), changes in marketing and changes in plant. The consultants then mention a number of techniques which can be drawn on to achieve improvements in productivity. In turn, these are discussed under four main headings: labour, materials, overheads and systems. The consultants cite evidence to show that relatively few companies do serious planning, and that the strategies and techniques which they list are greatly under-utilised in Ireland. The consultants also outline the qualities or personal characteristics of managers which are conducive to improvements in productivity. Finally, in this chapter, some approaches to improvements in productivity which involve all aspects of the firm are discussed. The consultants end their concluding remarks to this chapter by saying: "We have argued, very strongly in some instances, that the scope for productivity improvement is enormous. We firmly believe that the main obstacle to tapping the vast potential for productivity improvement is attitudinal—some managers are

disposed to taking the necessary steps, while others—who may even know all about the various techniques and strategies—are not so disposed."

6 In Chapter 5, the consultants emphasise that the methods which they outline are applicable to a wide variety of organisations and to the public sector, not just to industrial firms. They are also applicable to white-collar workers. Among the barriers to increases in productivity which are discussed in this Chapter are the following: weaknesses in management; deficiencies in organisation, e.g., with regard to the degree of centralisation or the design of jobs; and the lack of planning by firms.

III The Council's Conclusions

7 At the sectoral level, the Council has already published comparisons of labour productivity in Ireland and in other countries.[4] Productivity is a ratio between a flow of output and a flow of inputs consumed, both measured over a certain period. In principle, the most pertinent measure of productivity is "total factor productivity"—a ratio of output to the inputs of all factors of production, especially labour and capital. Due to measurement problems, the measure most commonly used is average labour productivity. This is an incomplete measure, since output results from the combination of all factors of production. Thus, productivity is a function of the capital and labour employed, the level of technology, and the way in which inputs are combined, among other things. Furthermore, even if the measure of labour productivity corrects for the number of man-hours, "labour" is not homogeneous, but embodies differing skills.

8 While labour productivity is a partial measure of productivity, it is the most readily available indicator of the trend of productivity over time. Table A gives the most recent data by which comparison can be made between output per person in Ireland and in certain other

[4]NESC, *Jobs and Living Standards: Projections and Implications*, Report No. 7, 1975; T. Ferris and A. Somerville, "Jobs and Living Standards: Projections and Implications", in: NESC, *Population and Employment Projections 1986: A Reassessment*, Report No. 35, 1977.

European countries. In 1975, output per person employed in Ireland in industry and in agriculture was less than half that in each of the countries considered: Belgium and Luxembourg, Denmark and The Netherlands. Output per person in services in Ireland was significantly less than in each of these European countries. Between 1971 and 1975, the gap between output per person in these countries and in Ireland became wider in the industrial and service sectors, while it narrowed in agriculture. However, the wide fluctuations in exchange rates, which have occurred since 1971, can distort these comparisons. When a comparison is made which is free of these fluctuations, then the measured gap in output per person between Ireland and these countries is lower.[5] But the trend—of an increasing gap between these countries and Ireland in the industrial and services sectors—is the same. In 1975, output per person in industry in Benelux and Denmark, taken together, was 65% higher than in Ireland. By comparison, in 1971, output per person in industry in these countries had been 41% higher than in Ireland. In 1975, output per person in services in these countries was 48% higher than in Ireland. In 1971, there had been a 39% higher output per person in this sector in these countries.

9 A comparison with Britain shows a much narrower gap in output per person, and one which has been narrowing over time. In 1971, industrial output per person in Britain was 8% higher than in the Republic; per capita agricultural output was over twice as high and output in services was 19% higher than in the Republic. For all sectors, this gap narrowed between 1971 and 1975. For example, by 1975, output per person in industry in Britain was 6% higher than in the Republic. Output per person in industry in Northern Ireland in both 1971 and 1975 was about the same as in the Republic. The narrowing gap in output per head between the Republic and Britain contrasts with the widening gap between the Republic and continental European countries. This reflects the fact that labour productivity in the United Kingdon—especially in manufacturing—has been declining relative to that of its principal competitors.[6]

[5]These comparisons are made in purchasing power parities—see note (a) to Table A.
[6]D. T. Jones, "Output, Employment and Labour Productivity in Europe since 1955", *National Institute Economic Review*, August 1976; *The UK and West German Manufacturing Industry Compared*, ed. M. Panic, National Economic Development Office, Monograph No. 5, 1976.

TABLE A

Indices of output per person at work, Republic of Ireland and other countries, 1971 and 1975: Republic of Ireland=100 (a)

Output per person at work, by sector	Great Britain		Northern Ireland		Belgium and Luxembourg		Denmark		Netherlands		Benelux and Denmark combined (b)	
	1971	1975	1971	1975	1971	1975	1971	1975	1971	1975	1971	1975
Agriculture	218.5	152.4	145.6	107.5	242.4	240.7	195.2	201.7	215.9	204.2	186.6	165.4
Industry	107.6	105.8	100.6	99.9	155.8	202.5	174.0	225.7	164.8	212.3	141.3	165.1
Services	118.6	113.2	101.6	105.5	159.7	194.5	176.1	195.9	153.2	181.5	138.8	148.2
All Sectors Combined	127.2	118.0	111.5	108.3	175.7	211.1	188.4	214.9	173.8	203.7	153.9	163.5

Note: (a) These data give the contribution to gross domestic product of each of the three sectors.
(b) In these comparisons, data for Benelux and Denmark are converted at purchasing power parity rates. In making these comparisons, the value of output is converted to its value in pounds. This can be done either through using official exchange rates, or through using a set of "international prices" called purchasing power parities. The comparisons which use purchasing power parities are given here, since exchange rates can be a poorer reflection of the relative purchasing power of different currencies.

Source: NESC, *Jobs and Living Standards: Projections and Implications*, Report No. 7, 1975, Tables 1, 3; Tom Ferris, 'Alternative Methods of Comparing Productivity and Living Standards: Ireland and Other EEC Countries', *The Irish Banking Review*, March 1978, Table 3.

10 Table B gives even more up-to-date information on relative trends in output per person. This table shows that gross output per person in manufacturing industry in the Republic of Ireland increased at an annual average rate of 4.7% per annum between 1970 and 1977, compared with an annual average increase of 2.5% in the United Kingdom in the same period. This means that gross output per person in manufacturing in the Republic has increased by 38% since 1970, compared with a 19% increase in the U.K. Most of the divergence between output per person in manufacturing in the Republic and in the UK took place in the period since 1974, when there was a much more rapid increase in the Republic. The difference in the trend occurs between the Republic and Great Britain, since in the period 1970-76 the increase in output per person in Northern Ireland was about the same as that in the Republic. Undoubtedly the contrasting trends in the Republic and in Britain have been partly due to structural changes which have occurred in industry in the Republic in the past few years as new firms, which have probably used better technology, have opened up. This has coincided with closures which occurred in certain low-productivity sectors. Thus, the average age of the capital stock in the Republic is likely to have been falling more rapidly than in the UK.

11 Hence, a qualification must be made to the above calculations of a gap in labour productivity between the Republic and other countries. Within a broad sector such as industry, some of the difference in productivity could be explained by differences in the mix of industries. For example, productivity could be lower in a country which had a relatively high proportion of industries in which, due to the type of technology, productivity was relatively low.

12 The Council considers that improvements in productivity are of critical importance for a number of reasons. First, productivity determines living standards (i.e. real income per head) in the country. Second, one of the principal ways in which the ability of Irish firms to compete in world markets can be affected is through variations in productivity. Indeed, given the fixed rate of exchange between the Irish pound and sterling, and given the fact that Ireland is a small open economy, the only way, at any level of money earnings, in which the ability to compete can be affected is through changes in productivity levels.

TABLE B

Gross output per person employed in manufacturing industry, Republic of Ireland, United Kingdom and Northern Ireland, 1970-1977 (1970=100)

Year	Republic of Ireland	United Kingdom	Northern Ireland
1970	100	100	100
1971	104	103	110
1972	108	109	113
1973	118	117	122
1974	118	115	112
1975	119	113	118
1976	131	119	129
1977	138	119	n.a.

Note: n.a.: not available.

Source: Irish Statistical Bulletin; Quarterly Industrial Inquiry; *Monthly Digest of Statistics; Digest of Statistics,* Northern Ireland.

13 The preceding paragraph is concerned with the exposed market sector. (The market sector of the economy consists of activities where goods and services are sold directly for money; within the market sector, some activities are *sheltered* from external competition, and the remainder are unsheltered or *exposed*).[7] However, productivity levels in the sheltered sector can matter, for the following reasons. For any given increase in earnings per person employed, the lower the productivity growth in activities in the sheltered market sector, the higher their price increases are likely to be. In turn, these price increases can lead to a defensive reaction on the part of all workers. Furthermore, higher prices for services which are provided by firms in the sheltered sector lead to increases in costs for firms in the exposed sector.

[7]NESC. *Prelude to Planning,* Report No. 26, 1976.

14 To sum up this argument: the extent to which Irish firms are competitive in export markets is determined by, among other things, the trend rate of growth in productivity relative to the rate of growth in money incomes. The increases in real income per person which are expected and demanded can be met without adverse consequence only if productivity increases—both in the industrial sector and outside this sector. In a closed economy, without productivity increases, these adverse effects would take the form of price inflation. In an economy such as that of Ireland, adverse effects are more likely to be lower employment than otherwise would be the case. Further, a relatively low rate of increase in productivity in the sheltered market sector of the economy can lead to domestic inflationary pressures.

15 The consultants refer to the impact which measures to increase productivity can have on the level of employment. The earlier paragraphs have implied that, given free trade and the expectations regarding real income increases, *in the exposed market sector the existing jobs can be protected and additional employment created through increases in productivity.* Indeed, the sectors which have suffered the greatest job losses in Ireland in recent years—e.g., textiles, clothing, footwear—have been those where productivity changes have not been large enough to keep these industries competitive as real income levels increased throughout the economy. In the short-run, employment can be maintained at static levels of productivity, but this is at the risk of a significant reduction in employment and lower living standards in the longer-term. This is not to deny that there can be considerable adjustment costs caused, and considerable dislocation caused to those workers who have to change jobs. This justifies Government involvement, not only in adequate income support for unemployed workers but in more intensive training and re-training programmes, and in curbing the barriers to labour mobility. It is through such measures that the apprehension that increased productivity will lead to loss of employment can be met.[8]

[8]Increases in productivity need not take the form of the substitution of capital for labour. Sometimes they do. There are difficult questions here, which include the possibility in some areas of using a technology which embodies a higher labour-capital ratio and which is efficient, and the extent to which the capital-labour ratio is influenced by the cost of labour relative to the cost of capital.

16 While increases in productivity—in industry, and in the services which are provided to industry—are necessary for a long-run increase in employment, they are not sufficient. They must be accompanied by increases in aggregate demand. Further, the higher the rate of increase in output, the higher the rate of increase in productivity is likely to be. The productivity increase must also be accompanied by increases in investment which lead to additions to productive capacity. Indeed, increases in productivity can encourage a displacement of imports and expansion of exports which will, in turn, lead to more investment.

17 The consultants' study deals only with productivity at the level of the firm and of the plant. It is to be expected that productivity levels will differ between industries or sectors, for example, due to differences in capital employed, in technology, in working methods and in attitudes to work. The Appendix in the consultants' study shows that there are great differences in added value (which approximates to net output) per employee, between one *industry* and another. Prior to the freeing of trade, there were great differences in labour productivity between *firms* in the same industry.[9] But one of the striking features of the industrial structure, which is pointed out by the consultants, is that great differences still exist in productivity levels between firms in the same sector. These differences cannot be explained by differences in product mix or in techniques of production: it has been shown that there are significant differences in productivity between international companies which make similar products by similar processes in a number of different countries.[10] This illustrates the inadequacy of crude aggregate indicators of competitiveness such as unit labour costs. These measures have the disadvantage that they can cloak the disparities in technology and in efficiency at the level where decisions are taken—the level of the firm. The consultants' study indicates that, for any given type of output in the industrial sector, there is still considerable room for firms to increase productivity to the levels achieved by the more efficient firms in their sector.

[9]See T. P. Linehan, "The Structure of Irish Industry", *Journal of the Statistical and Social Inquiry Society of Ireland*, 1961-1962, especially Table A5 which shows the distribution of establishments by net output per head.

[10]C. F. Pratten, *Labour Productivity Differentials within International Companies*, Cambridge University Press, 1976.

18 The earlier paragraphs have indicated that changes in productivity influence not only living standards, but potential for output growth. Paragraph 15 has indicated that, in the trading environment of Ireland, a relatively low growth of productivity can eventually lead to a reduction in employment. Increases in productivity are the means through which jobs can be safeguarded and increased. Despite the availability of the various Government aids, the productivity of private and public enterprise has continued to lag behind that in continental European countries. The Council feels that the consultants' study demonstrates the need for a more positive approach to productivity in all sectors of the economy. The response to this need must come from people at the level of the enterprise—whether private or public—and at the level of the plant. The consultants' report should be of help in evoking that response, both in the public and in the private sector, and the Council encourages all concerned—both labour and management—to read it.

PART II

PRODUCTIVITY AND MANAGEMENT

by

HOWARD GREER

and

EDDIE MOLLOY

CHAPTER 1

INTRODUCTION

According to the Government Green Paper, *Economic and Social Development, 1976-1980,* published in September, 1976,

> "No other country, or group of countries will solve our economic problems for us. We will certainly benefit, in our international trade, from the growth of prosperity in our trading partners if we do not price ourselves out of those markets by our own excessive inflation rates. *But the main effort must come from ourselves; we must curb our own inflation, raise our output and productivity and sell our products on internationally-competitive markets*" (p.1) (italics ours).

Irrespective of the incentives or barriers posed by the business environment, the Government or other bodies, the principal agent or cause of productivity improvement is the manager: responsibility for the success of an enterprise rests with its management.

Throughout this study, we take the view that the role of management is central to productivity and productivity improvement. But we do not set out to lay blame for poor productivity at the feet of any one group of people. We maintain that productivity is a highly complex concept, and that productivity increase can be achieved only through the concerted attempts of every person working within an organisation, using what assistance they can get from outside agencies.

It is this orchestration of effort that places the manager in such a central role. In this study, we have attempted to outline the various factors that determine productivity levels within an organisation, the ways in which managers actually influence these factors, and the

means by which managers may help to bring about productivity increase.

Throughout the study several themes are repeated time and again. First, in each area in turn we maintain that the scope for productivity increase, even in the short term, is immense. Second, we stress that productivity increase in an enterprise is not to be obtained merely through the increased effort of individual workers within it, but rather that it depends on the efficiency and effectiveness of the enterprise as a whole. Third, we try to highlight the need for a scientific approach to management throughout every facet of the organisation: by this we mean systematic measurement, monitoring, and planning. Finally, we emphasise that the task of increasing productivity, and the means of achieving it, apply to all sections of all organisations: be they managers or "workers", in manufacturing or services, in the public or private sector.

The core of the study is centred around the strategies and techniques by which increases in productivity may be obtained. We do not suggest that they are new—if anything, rather the reverse. They are, for the most part, known and readily available. We, therefore, maintain throughout that the means of achieving productivity improvement lie in the manager's hands. What is needed most urgently is the will to apply what is already known.

CHAPTER 2

PRODUCTIVITY: DEFINITION AND MEASUREMENT

2.1 Popular View of Productivity

Productivity has acquired a variety of meanings. They can often cause confusion or ambiguity, particularly when the productivity of the total organisation is in question. As the definition and proper measurement of productivity depend upon the context, it is not unusual for disputes to arise out of the use of different and sometimes inappropriate measures, or out of the incorrect interpretation of appropriate ones. Also, the range of factors that determine organisational productivity is frequently conceived too narrowly. It is necessary, therefore, to discuss the meaning and breadth of the concept of productivity in organisations, the suitability of the various methods that are used to measure it, and the full range of factors that determine the level of productivity.

Much of the current ignorance about productivity and the inflammatory connotations it sometimes acquires are embodied in myths that are rarely questioned.

Myth No. 1: "Productivity=Profitability". Rate of return on capital does provide a measure of capital productivity, but certainly cannot be taken as a measure of organisational productivity. On the other hand, when profits are expressed as return on revenue, then this figure bears no relation to productivity at all. This fact has been underlined (*Financial Times,* 1975) by a recent comparison of UK and other European firms, which revealed that the British were "more profitable (return on revenue) but less productive (return on capital)."

Myth No. 2: "Increased Productivity=Increased Effort", particularly on the shop floor—this after all is the basis of many productivity payments. We would argue that increased productivity can be achieved without any change in employee effort and that increased effort need not result in a corresponding increase in productivity.

Myth No. 3: "Productivity=Manual Worker Output per Person". A significant number of responses to a survey carried out by the writers in 1976 showed that many managers considered that the concept of productivity does not apply to organisations which do not employ "blue collar" direct operatives. Some felt that, because of the difficulty of measuring productivity in other areas, the concept could not be applied to them. Moreover, the fact that productivity is often spoken of in terms which suggest that the blue collar worker is the only element of the organisation influencing productivity levels fosters this myth. Productivity improvement is not anti-labour but an objective for labour and management to achieve through co-operation.

Myth No. 4: "Increased Productivity=Cost Reduction". That cost reduction may be an important element in productivity improvement is undisputed. However, cost reduction should represent only one aspect in any programme for productivity improvement. Any such programme should also contain real contributions to future expansion.

Myth No. 5: "Productivity Improvements=Redundancy". There can be no doubt that in the short term an effect of productivity improvement may be redundancies. But it is important to point out that this is particularly associated with efforts to maintain productivity during the contraction phase of business cycles. It can also be pointed out that, in economic circumstances in which growth becomes possible, increased productive efficiency is the only means whereby real and lasting employment growth can be secured.

2.2 Definition and Scope of Productivity

The productivity of a system is defined as the ratio of total outputs to total inputs. In this sense, it is directly comparable with the engineering definition of efficiency. Productivity so defined is difficult, if not impossible, to measure. It is usual for other, less complex, indices to be used as indicators of the level of productivity. They may be used to compare one economic unit with another, or to compare the performance of the same economic unit over a period of time.

For business organisations, which exist to achieve a set of clearly defined primary objectives, productivity does not refer solely to that balance between all the factors of production that will give the highest output for the least effort.

Because the longer-term strategy[1] of the organisation in achieving these objectives will materially affect its performance, productivity is also a measure of how well the organisation is managed, in terms of the achievement of its major objectives. Thus productivity has dual foci: the organisation's efficiency, (i.e. the value of the output-input ratio) and its effectiveness (i.e. the degree to which the output meets predetermined ends). Effectiveness refers to doing the right thing. Efficiency refers to doing it well. High productivity requires that the organisation is both effective and efficient, hence the central role of management. Management and productivity are inseparable.

2.3 Measurement of Productivity

Rarity of attempts to measure

The management of productivity, then, is central, for without productivity objectives, a business does not have direction. Equally, without productivity measurement, it does not have control. (cf. Withers *et al,* 1977). Yet the reluctance of firms to measure more than one or two aspects of productivity is such that few companies can have any clear idea of how their own productivity compares with the productivity of other organisations.[2] The use of inter-firm comparison as a means of assessing relative performance within a sector is still confined to few organisations, particularly in this country, where only one or two sectors have a locally based comparison service—though a few make use of UK and other European services.

Total measures

Isolated attempts have been made—though the writers know of none in this country—to measure productivity levels absolutely, through

[1] "Strategy" throughout this study may refer to the formal or informal means whereby organisations are to achieve their objectives. Many organisations do not have a clearly formulated strategy, but most do have some idea as to how their present circumstances will be developed to meet the future.

[2] Such a lack of awareness of productivity and how to measure it is by no means confined to this country. In the US virtually no organisation was able to go before the Price Commission with any reliable data concerning their productivity levels, when there was a requirement for justifying price increase requests. The Commission was eventually forced to abandon this requirement and rely on aggregate figures supplied by the government.

literal interpretation of the definition (the ratio of total output to total input). The relationship, then is

$$P_T = \frac{O_T}{L+C+R+G}, \text{ where}$$

P_T = total productivity

O_T = total output (incl. dividends and interest earned)

R = Raw materials input factor

L = Labour input factor

C = Capital input factor

G = Miscellaneous goods and services input factor

Financial values are usually applied to all factors, but a major difficulty arises in determining a realistic value of the capital input factor. One application (Craig and Harris, 1972) used a concept of "lease value" as opposed to change in "book value": the capital input factor was defined as the sum of annuity values for each asset on the basis of initial cost, productive life and cost of capital. For year-to-year comparative purposes, the index must be reduced to a base year, making adjustment not only for inflation, but also for such things as new products/quality changes.[3]

It will be clear from this brief discussion that total measures are not only extremely difficult to obtain, but once obtained are also open to question in terms of absolute values. Moreover, since no comparable data can readily be obtained for other organisations, there are still no external data with which to compare performance. However, as indices for internal period-to-period comparison they can be useful. In addition, periodic analysis may be expected to highlight shifts in relative factor prices. But as the following chapter in this study attempts to show, the influences on productivity are many, and sometimes complex, and the use of a total index as described above cannot be expected to highlight all of these.

[3]Another application (Faraday, 1971) reduced all inputs—including raw materials and capital factors—to "equivalent man-years".

Partial measures or indicators

The alternative to total measures is to make use of a series of indices which relate output (usually) to a single input factor. For comparative purposes, the extensive data published in the CSO *Irish Statistical Bulletin* may be used, though rarely are (for instance, the NESC study *Jobs and Living Standards: Projections and Implications*—Report No. 7). Broadly speaking, the most frequently used partial indicators can be classified into four groups.

(i) *rate of return on capital employed*;

(ii) *ratios of output to labour input*; output may be expressed in physical (e.g., tonnes/year) or financial (e.g., revenue plus or minus stock change) terms. "Clock-to-standard hours" is also sometimes used, but this kind of measurement is strictly one of worker efficiency, and of limited value in a wider context;

(iii) *ratios of added value to labour input*; because gross output in financial terms includes the value of raw materials and other "bought-in" products, net output or added value provides a more satisfactory output measure for productivity indicators. As information in terms of added value per employee is included in the CSO Bulletins and Census of Production Analyses, external comparisons can readily be made, though on an industry basis only. The additional fact that company information expressed in terms of added value provides the basis for a wide range of corporate decisions makes its use very attractive. (Serious recommendations have been made in this country and elsewhere that information on corporate added value be included in company accounts.)

(iv) *ratios of output or added value to combinations of input factors*, principally to a combination of labour and some measure of capital investment. It has been shown (Salter, 1960, de Bandt, 1975) that the rate of annual capital formation may be substituted for capital employed, and comparison may thus be made within a sector by comparing added value per employee at constant levels of annual capital investment. This is discussed further in Chapter 3, section 5 (b), and also in Appendix 1.

It is disturbing that so little effort has been made to determine realistic indices of productive efficiency. It is even more disturbing that indices which companies do employ are so frequently interpreted in a narrow sense. Measures such as added value per employee, whilst they may strictly be indices of labour productivity, are also indicators of overall productivity, particularly if adjusted for differing capital factor levels. They just as surely indicate the contribution of management to productivity.

2.4 Conclusions

(a) No single, universally-applicable index of productivity is available: it is necessary for organisations to tailor their own indicators to their particular circumstances.

(b) Because productivity is a complex concept embracing a wide range of influences a range of indicators should be used by organisations, rather than just one. A range of partial indicators may be more useful than a single total index. Measurement should permit comparison with other organisations within the same sector. Added value per employee, allowing for varying rates of investment, may be the most useful indicator.

(c) Great care must be exercised in the use of productivity indicators.

> "We cannot divorce changes in the productivity of one factor from the productivity of other factors, or indeed, from all the elements in an interrelated economic system. Measures such as labour productivity must be interpreted in this light—otherwise we run the risk of giving them a significance they do not deserve." (Salter, 1966, p. 3)

Much injustice can be done by the improper interpretation of partial productivity indicators, for instance, by over-literal interpretation of labour productivity indices in wage negotiation.

(d) Data are freely available for use by organisations in assessing their productivity. These data are rarely used. Even when allowance has been made for the difficulties and time involved in making quantitative comparisons, the small size of many

operations, the frequent need for the use of impressionistic comparisons etc., the absence of quantitative studies of productivity by many companies remains striking. The very limited use of inter-firm comparison studies in this country shows a lack of concern for levels of productivity. It appears to the writers that productivity is rarely discussed outside the context of labour productivity, especially "worker" productivity. Even within this context the importance of influences other than efficiency—influences relating to strategy and tactics—is frequently underestimated.

(e) For managers who wish to make comparisons of sector-by-sector productivity levels in Ireland, or who wish to make comparisons of their own performance within their sector, a method of carrying this out is described in the Appendix. The method in this Appendix is based on the discussion in Chapter 3.5 (b) (see below).

CHAPTER 3

MAJOR DETERMINANTS OF PRODUCTIVITY

3.1 Introduction

In Chapter 2 we discussed some of the ways in which productivity levels can be quantified. As we have indicated, we feel that it is important that firms should develop a range of indicators of their productivity. But even where a total index is developed, using the factors of output, capital, labour, materials and so on, this does not begin to explain the fundamental reasons why productivity levels are as they are. These factors and the resulting levels of productivity, are determined by a range of dynamic influences, both internal and external to the firm. It is by manipulating these influences that managers may bring about productivity change. So far, then, we have only discussed productivity in a "static" sense. We now turn to the dynamics of productivity change within an organisation and attempt to outline briefly some of the more important determinants of productivity, and the effects they have on levels of productivity.

It is important to note that it is the rate of change of productivity that must be of overriding concern to managers. Levels of productivity have, after all, continuously improved almost universally throughout this century. Thus, managers must be concerned with maintaining satisfactory relative rates of improvement of productivity for their organisations.

It is also important to note that productivity improvement itself, in turn, has a pervasive and complex effect on each of the factors listed. For instance, it can be shown that above-average increases in output per hour are associated with below-average increases in all costs, not only labour costs but also materials and gross margin costs. So the relative importance of any one influence is difficult to gauge. Moreover, the cumulative effect of many small unnoticed modifications and improvements may be equal to the impact of more dramatic changes.

This makes analysis of the relative importance of the different factors that influence productivity even more difficult.

3.2 External Influences

The external influences on productivity change, with which managers must cope as best they can, are legion. Government policies on taxation and legislation, and national agreements on wage levels, are obvious examples.

The major external influence in the short term is the expansion and contraction of business. During expansion, productivity may be expected to increase as production volume increases up to the point of optimum utilisation. Before the expansion peak is reached, a decline in productivity growth rate is likely, as optimum utilisation points are passed, inefficient plant and labour is brought into use, raw material shortages develop, and managers become less cost-conscious as they continue to make exceptional profit or meet an exceptional demand for what they produce. As business contracts, rates of productivity increase fall sharply and may even become negative well before the trough has been reached. Before the trough is reached, however, this trend in productivity change may be expected to slow down, and, in fact, to reverse again under management pressure and the effect of severe lay-off of labour. As business begins to expand, productivity increases sharply, at least in the initial stages. This check to productivity growth was apparent, particularly during 1975, when industrial output declined by over 6% and productivity growth ceased.

3.3 Product Influences

3.3.1 The Sector

The industrial sector in which the organisation operates is a major influence on absolute levels of productivity in terms of added value per employee. This remains true even when adjusted to allow for differing rates of capital investment between sectors. Comparisons, therefore, with organisations from another sector are often misleading. However, it appears to be the case that where significant overall productivity differentials exist between countries, the industrial sectors in which firms operate do not affect the direction of the productivity differential, although there remain differences in productivity between industrial sectors. Thus, adverse overall productivity differentials tend to apply also to the individual sectors.

3.3.2 Product Range and Degree of Specialisation

The extent of the product range appears to have a major effect on the level of productivity and on the rate of growth possible for a firm. When it is necessary, for whatever reason, for a firm to offer a wide product range, this clearly has a major impact not only on production itself, but also on all of the services to production, for example, production control. The degree of specialisation would appear to be of special significance. In one investigation (Pratten, 1976) of the effects of specialisation on labour productivity, it was found that the greatest benefit to productivity was achieved by moving to 100% specialisation, for example, the production in one factory of a single brand of cigarette in a single type of pack. Significantly, the last 10% move to full specialisation was worth more than similar preceding shifts.[1] Moreover, where expansion of output of a narrow range of products is involved, rapid rates of growth can normally be achieved without major problems, as can a consequent additional impact on productivity through increased output (see 3 (a) below).

3.3.3 Complexity of Design

Differences in product design which reduce the number and capacity of parts will also ease the problems associated with production control and purchasing and, by the reduction of changeovers,[2] facilitate further utilisation of the most efficient machines and management. Also, where pressure exists to release working capital from stocks of finished and in-process components, very much higher levels of utilisation—and therefore productivity—can be achieved for the same investment in stocks where fewer components are involved. This effect is sizeable and must be a source of considerably increased productivity in times of cash shortage. As against this, complex designs involving high added value relative to the input of labour may result in high levels of productivity even when produced in low volume. But management

[1]However an alternative strategy may be the direct opposite to specialisation. Increased diversity of high added-value products may be more productive—and may provide more secure markets by raising barriers to entry by competitors based on technical ability rather than price.

[2]"Changeover" refers to the downtime and extra cost due to setting up new batches. This may be a very significant cost element in some firms, and is often virtually uncontrolled by any system.

controls must be capable of coping with this complexity. Value added must be sufficiently high to permit the control of overheads necessary for efficient production or, once again, productivity will suffer.

3.4 Market Influences

3.4.1 Market Size, and Rate of Growth

Market size is undoubtedly one of the major influences—if not the single most important one—on productivity levels, affecting as it does both rates of output and length of production runs. In a study of the causes of productivity differentials between international companies based in the UK and US, Pratten (1976) found a 20.5% differential in productivity (out of a total differential of 50%) due to market size. Hence the need for companies to expand their markets is paramount. It should be noted, however, that expansion into export markets may also produce adverse effects because of the greater diversity of products required. Kennedy (1971), using extensive data for Irish Industry, has established the strong positive correlation between rate of growth of output and labour productivity in manufacturing industries; and has hypothesised that

> "The most plausible explanation of the association between the rates of growth of output and labour productivity, consistent with the associated movement in relative costs and prices, is, therefore, one that allows for the interrelations between changes in scale and technological progress" (p. 219)

The influence of scale and technological progress are mentioned below.

3.4.2 Pricing

Apart from the obvious effect of differing price levels on value added, the concept of price adjustment for revenue and profitability maximisation is well known but perhaps rarely practised as rigorously as it might be. Increase in volume can also be expected significantly to affect labour productivity *per se*. In view of the extent of likely productivity gains to be achieved thereby, it seems surprising that, where elasticity of demand is likely to be in excess of unity, a strategy

of reduced price to achieve higher volume is not pursued more often (Grayson, 1973).[3]

The two-way interaction between pricing and productivity change has been noted by Salter (1960):

> "The implication is . . . that the gains of increased productivity have been distributed to consumers by means of price reduction—or smaller increases in prices than would otherwise have occurred." (p. 162)

Where policies are also being pursued to combat inflation the central role of pricing policy is obvious.

3.4.3 Stability

Although changing demand—due to changes in tastes, habits and life-styles—may itself be expected to influence productivity change through increased absorption of new techniques (because some changes in demand are reflected in product changes, which in turn are related to changes in both product design and production techniques), the negative influence of changing demand on productivity should not be under-estimated. This is particularly so in industries where the products are very complex. Product development and production engineering costs, having shorter runs over which to be absorbed, become significant. The extent of the "learning curve effect", although well known, is often not fully appreciated. For instance, where an 80% learning curve applies, average labour hours decrease by 20% each time the output is doubled.[4] The significance of this effect on productivity, particularly where runs are very short, is enormous.

[3](a) The term "elasticity of demand" is used to indicate the degree of responsiveness of the quantity of product sold (Q) to changes in price (P). Elasticity of demand is said to be in excess of unity when a cut in P raises Q so much as to increase total revenue P . Q.

(b) But in an off-shore economy such as Ireland's, a strategy such as this may not be possible: price levels are more often established by outside competition.

(c) Also, caution is necessary in this regard, whilst inflation rates remain high: price levels must be set having regard to the ever-increasing cost of re-investment, etc.

[4]Liao and Noftsinger (1977) describe the learning curve as follows: "When new products or processes are initiated, a learning effect phenomenon occurs. As experience is gained, productivity becomes greater. The learning curve effect may be expressed quantitatively by an exponential function which describes that later units can be produced at a lower cost per unit than earlier ones. An 80% learning curve has been found to be typical in some industries. That is, in these industries, average labour hours required per unit decreases by 20% each time the output is doubled."(p. 23)

3.4.4 Seasonal Fluctuation

The influence of seasonal fluctuation on utilisation of resources, whether due to seasonal variations in demand for finished product or seasonal variation in supply of raw material, must be large. The problem of large seasonal variation in supply is normally more intractable, especially as this often obtains where shelf life of the raw material is limited. In industrial sectors where this is a major problem, annual variations can usually be allowed for at the planning stage, but short-term variations in supply are often such that management action is incapable of ameliorating their effects. This is a real problem—for example, in much of agri-business—and new management techniques are needed to tackle it.

3.5 Scale Influences[5]

Much of what has been pointed out above, particularly in relation to market size, and market stability, has a direct bearing on scale as an influence on productivity. For management the approaches to possible economies arising out of increased scale lie in the area of marketing strategy. However, there are direct factors affecting productivity levels arising out of scale effects which management may influence.

The nature of the influence of scale on productivity has been noted above. Pratten (1976) notes, in relation to labour, that

> "On average, a doubling of the rate of production of products or production runs increases productivity by about 14%. Similarly, a tenfold increase in rates of output raises productivity by 54½%. Put another way . . . in the long run, to double the rate of output of a product, a firm has to increase its labour force producing that product by about 75%."[6]

Scale as an influencing factor is complex, and there is likely to be a great difference between industries in the extent to which economies of scale can be captured.

The major cause of scale economy is the fact that costs per unit are higher for small than for large runs. But other causes exist, for instance,

[5]Much of this section has been heavily influenced by Pratten (1971) and Pratten (1976).

[6]It should be noted, however, that an earlier study (Pratten, 1971) showed that "economies of scale for labour costs were found to be much greater than for total unit costs of production".

inefficiency. In part, scale differences exist in the first place because the less efficient manufacturers are left to produce the odds and ends. Thus poor productivity may itself be the cause of further adverse influences.

Many of the sources of these economies have already been mentioned: for instance, economies through spreading indivisible costs such as initial design and development over a larger throughput. Economies may also result from the fact that often capital investment need not increase proportionately with volume of output. A major source of economy may result from the fact that, as scale increases, the degree of specialisation of labour may also increase, causing a more than proportionate increase in labour productivity. Specialist services are also more readily available: for example, the percentages of Irish firms which had made use of work study (Gorman, *et al*, 1975) were 79.2% (firms employing 500+); 58.0% (firms employing 100-499); and only 22% (firms employing 25-99). A further source of economies is financial economies—e.g., it can be easier for a large firm to tap the capital markets. Diseconomies may result from poorer quality of labour relations in larger organisations, and increased difficulty in motivating all levels of staff. Also other costs, such as costs of selling and distribution, may increase disproportionately with increased scale.

Potential productivity increases from increased scale may be substantially eroded through declining management effectiveness, when management control is too centralised, with consequent loss of flexibility and the ponderous nature of a large centre (see Atterton *et al*, 1976). Moreover, as the span of management is extended, effectiveness may be diminished because of delays and defects in communicating; and costs may be increased because of more costly and less efficient information systems.

3.6 Influence of Technology and Capital Formation

3.6.1 "Best-Practice" Technology

"Best-Practice" technology means the most appropriate production technology and/or techniques, with current technical knowledge and relative factor prices.

As technical knowledge advances, and/or as the costs, say, of labour relative to capital change, so best-practice techniques will change also. Usually both technical advance and changing factor prices are

involved—the advance from manually operated capstan lathes to modern numerically controlled automatic lathes provides an example. The vital role of the use of best-practice technology in improving productivity is now well known, as is the importance of the delay in the utilisation of new techniques. The importance has been demonstrated (Salter, 1966) for the US Blast Furnace Industry, where average labour productivity, at the time of Salter's study, was only half best-practice productivity. Thus, if all plants were using the best-practice standards known, labour productivity would have been doubled. Perhaps even more significantly, it was fifteen years before this occurred by which time the potential provided by best-practice had more than doubled. This is not an isolated case.

So the crucial factor is the rate of absorption of new technology into industry, and the strength of the "friction of history". Keynes wrote that

> "It is by reason of the existence of durable capital equipment that the economic future is linked to the present." (1936, p. 146)

Analogously, durable capital equipment links present production with past technology. This must be one major reason for expecting significantly higher relative levels of productivity from the "green fields" industrial projects (i.e., projects which are not constrained in their planning, by previously purchased buildings or machinery, and which are therefore not linked by capital equipment with old equipment and/or out-moded techniques) sponsored by IDA, though there are other equally significant influences at work in these projects.

3.6.2 Capital Investment

The existence of a link between capital formation and new technology in this context is obvious: capital formation is the major means whereby new technology is absorbed into an industry.[7] For Ireland, total increased capital investment, the major contribution to which came from the industrial sector, was 4½% in 1976, following declines of 5% in 1974 and 6½% in 1975.[8]

Here, however, we are not simply discussing the absolute levels of investment in capital equipment—we are also talking about the rate of

[7]Of course there are other major influences. The influence of management is discussed in detail elsewhere in this study. Also the transfer of staff from sector to sector may be an influence on the transfer of new technology.

[8]*Economic Review and Outlook*, June, 1977.

replacement of capital equipment through sale of outdated plant and purchase of new equipment embodying newer technology—we are talking about a dynamic influence on productivity. If a company needs investment to utilise new production techniques, then it follows that the higher the rate of replacement investment, the quicker the new techniques come into general use.

The CSO Census of Production tables of changes in fixed capital assets for each industry contain both gross and net increases in fixed capital assets and also the extent of replacement investment for each industry. Quantitatively, the extent of the relationship between these data and levels of productivity has been established for most of the industrialised nations (de Brandt, 1975, and Withers *et al*, 1977), and recently for Ireland (Greer, 1977).[9] Appendix 1 of this study provides an analysis of this data for Ireland covering the years 1964 to 1973 inclusive.[10]

The rate of replacement of capital equipment elsewhere is staggering. One analysis (Seitz, 1977) suggests that

> ". . . by the end of this year over 60% of Japan's equipment will be 5 years old or less. Only half of France's and West Germany's equipment will be over 5 years old". (p. 30)

In view of the importance of their influence on productivity change, the availability of capital and the willingness of management to replace existing production techniques and plants must be of major concern.

3.6.3 Process/Product Evolution

Mention has been made of the advantageous position of the "green fields" ventures, not only in the possibilities for sweeping introduction

[9]A straightforward linear relationship produces correlations in excess of $r^2 = 0.7$, for most countries, including Ireland: Withers *et al* (1977) found even better correlations for their data using a relationship of: productivity = a (capital intensity)^b, where a and b are empirically determined constants. It should be said, however, that the cause-effect relationship, and the directness of the relationship, are by no means clear. For instance, does productivity follow increased investment, or does increased investment arise because of higher productivity and higher profits?

[10]Reference is also made to an important contribution by Geary (1965), which contains interesting proposals for internal use of the statutory Census of Industrial Production returns and other data.

of new techniques[11] but also, for example, in the greater suitability of siting and the premises themselves. But for many of these companies, process evolution has already developed to a stage at which productivity improvement becomes significantly more difficult. As process development continues over time its overall nature is significantly altered, in line with alterations in the development of the product and its market. The various stages of development have important influences on technological innovation and on productivity improvement. For instance, a firm manufacturing a wide range of largely customer-specified products will probably do so using general-purpose equipment and labour with a broad range of performance skills. In fact, all facets of the process will be determined by the undeveloped, "untried", nature of the product. Innovation will tend to be associated with frequent product change, and because of a general lack of process constraint to innovation, there are great opportunities for productivity improvement. As significant volumes begin to be achieved in a few products, and the range becomes more rigid, the production process becomes increasingly more "tailored". Productivity gains result from changes in the process characteristics (technology, labour, capacity, material input); but as process evolution develops to its final stage, significant productivity improvement becomes increasingly more difficult and costly. (See Abernathy & Townsend, 1975; Utterback & Abernathy, 1975 and Abernathy & Utterback, 1975). The strategic significance of this for management is very great in the longer term planning of organisations. Much of Irish-owned industry remains at an early ("uncoordinated") stage in process development[12]—a stage when, if management influence were sufficiently strong, significant changes in productivity could be effected with little increase in investment. It is disturbing, therefore, that the necessary R & D is least likely to occur in industries that have stagnated at this stage.

[11]Requirements for labour requirement may be a negative influence here: the writers are aware of at least one plant operating at higher manning levels than are necessary, apparently because of agreements made at the time of setting up the plant. Extra equipment would yield higher productivity with reduced staff.

[12]The results of recent (unpublished) survey work carried out by the Irish Management Institute indicates that, at least in certain sectors, a large number of smaller firms do not as yet have a clearly-defined product or product range.

3.6.4 Level of Backward Integration

Backward integration is the process of absorbing the supply of assemblies, components and other raw materials into one's own operation. The extent of backward integration would appear to be linked to the rate of product innovation. The level of backward integration in this country would appear to be low (perhaps due to the relatively short history of industry here and, again historically, the small market size). Because product innovations at low levels of process evolution become process innovations—and therefore opportunities for productivity improvement—at higher levels, this means that at least to this extent management's influence on productivity in their own organisations is limited by innovations elsewhere.

3.6.5 Management and Technological Change

It would be wrong to assume that the influence of new technologies is in itself a force acting to increase productivity at a given rate; this pace is clearly highly susceptible to management influence, indeed—

> ". . . the real contribution to productivity in the form of technological innovation may often be assigned to creative problem-solving rather than the stimulation of advancing technology". (Abernathy & Townsend, 1975, p. 386)

The rate of performance improvement of many types of machine is so rapid that Pratten reports that firms found that it was often necessary to scrap machines while technically still serviceable, to achieve the highest levels of productivity. However, the implication that the continued use of out-dated capital equipment is a sign of poor management is not necessarily correct, for the extent to which out-dated methods can survive is determined by relative factor prices: for instance, low relative wage costs are not conducive to substitution of capital for labour.

But the implications for management arising out of this major set of influences on productivity are far-reaching: and much of management strategy should be directed to the management of these influences.

3.7 Influence of Labour Characteristics

The subject of this section, and of the following one dealing with the direct influence of management and management systems on

productivity, will be dealt with fully in later chapters. It is unnecessary, therefore, to consider them in detail at this point.

The extent of "behavioural" influences on productivity is indicated, again by the results of Pratten's study of differentials in international companies. This showed adverse "behavioural"—in this context, strikes, major restrictive practices, etc.—differentials as shown in Table 3.1. Estimates of differentials caused by "economic" influences, and total estimated differentials, are also shown:

TABLE 3.1

Summary of the Causes of Productivity Differentials between UK and Other Countries

	UK-Germany %	UK-France %	UK-N. America %
"Economic"[1] causes	13	9	35
"Behavioural"[2] causes	12	5½	11
Total differential	27	15	50

[1] "Economic" causes here are principally: differences in rates of output and lengths of production run and differences in plant and machinery.

[2] "Behavioural" causes are: incidence of strikes and major restrictive practices, and differences in manning and efficiency.

The figures from a comparison of all firms (as opposed to international firms only) are somewhat different, but the clear general implication is that the contribution of the labour force to national productivity differentials is ". . . significant, but not very large", when compared with economic causes. This is by no means to say that the influence of labour, and the means for increasing labour productivity, are relatively unimportant; on the contrary, it is conceivable that this is the ripest area for massive productivity improvement in all countries in Pratten's survey. But it is worthwhile keeping labour attitude in perspective

when discussing productivity, particularly in the light of apparent beliefs in negotiating productivity agreements that labour can achieve and sustain higher productivity levels at will without reference to any of the other major influences on performance. It should also be borne in mind that efforts to alter labour attitudes through, for example, changes in the structure of manual tasks in a process may conceivably represent a general reversal in the direction of process evolution, through less specialisation and more discretion on the part of labour, and a general loss in the rationalisation of major processes. Within the framework of the dynamics of other productivity influences, therefore, such moves may thwart long-range productivity improvement.

There is clearly much work which could be done in this area: for instance, the lack of correlation found, in a number of studies, between differential increases in earnings and labour productivity, implies that productivity gains have not been distributed to workers in the industries where the gains have originated; obviously wages are not, and should not be, related solely to productivity, but this finding may point to some omission in wage policies. Whatever may be the components of wage payment, it must ultimately be financed by the corporate pool of added value, and to that extent at least must relate to productivity levels.

3.8 Influence of Management and Management Systems

This influence is dealt with more fully in Chapter 4; management pressure as a second-order influence on productivity via all of the other influences has been mentioned above. Changes made by management also constitute direct influences on productivity—for example, in an examination of the development of manufacturing processes it was found (Bright, 1958) that increases in productivity were often made possible by managerial changes in the process itself. In addition, comments on labour attitude and motivation may be said to apply equally to managers as to others.

A major area of direct influence is the administrative efficiency of management: the effectiveness of management information and control systems, attention to methods and capital utilisation, and the slack that is allowed to enter these systems through drift over a period of time. An indication of this may be the manning of indirect (for example, inspection or maintenance staff) functions: manning levels in

indirect areas would appear to be less, in general, in the US than in Europe.

The extent of integration of the product line and its requisite processes into a system is likely to have major influence on productivity improvement. Because of traditional demarcation of management functions, such integration is rarely found product line objectives tending to be separately established by R & D, marketing and production, rather than to benefit the system as a whole.

Finally, the psychological and social strategy whereby change is brought about is, in itself, perhaps the single most important influence on productivity change, and much of this study is concerned with the way in which this process may be managed to ensure as little unnecessary resistance as possible, and to engage in a constructive way everyone who will be affected by the changes.

CHAPTER 4

THE MANAGEMENT OF PRODUCTIVITY IMPROVEMENT

4.1 Introduction

In essence, all management practice is ultimately directed toward improving productivity. The state of management practice in Ireland has been very thoroughly investigated by Liam Gorman and others (Gorman *et al*, 1975) who have provided detailed information on the relative strengths and deficiencies in the way Irish companies are managed. Their findings, for instance, that far too few companies do any serious planning, ought to be studied by anyone seriously interested in productivity improvement.

Of the many techniques employed by managers, some relate more directly to productivity improvement than others, and it is the purpose of this section to categorise and describe productivity-related techniques. In addition to what are typically called techniques, there is a listing of strategies which are known to influence productivity significantly. Moreover, there are a number of personal skills which ought to characterise the manager who wants to improve productivity. Finally, there are a number of broadly-based approaches to improving efficiency and effectiveness which do not readily fall into the other three categories. These additional means to productivity improvement have a number of distinctive features, including an explicit emphasis on the process of changing an organisation and a stress on the need for tackling the organisation as a whole. There are, therefore, four main subsections to this chapter:

Management Strategies for Improving Productivity.

Management Techniques for Improving Productivity.

Management Skills Conducive to Improving Productivity.

Organisation-wide Approaches to Improving Productivity.

4.2 Management Strategies for Improving Productivity

4.2.1 Introduction

In an earlier section, the distinction was made between efficiency and effectiveness (which refers to strategy). Low productivity is caused by (i) inefficient conduct of present strategy and/or (ii) a strategy no longer appropriate to the firm's competition, markets, or the economy. An investigation (Schendel, Patton and Riggs, 1976) of the causes of corporate decline and recovery concluded that

> ". . . uncontrollable environmental changes of an unfavourable nature were important causal factors in downturn. . . ." (p. 11)

but that

> ". . . the environmental changes would not have made the impact they did "if" management's inaction had not left the corporate body in a weakened state." (p. 11)

They add, most significantly, that

> ". . . upturn was not prompted by favourable environmental events. *The key to upturn is explicit action by management.* Specifically, management must properly assess whether the corporate strategy is well suited to its environment or whether it must be changed." (p. 11) (italics ours)

In other words, the principal agent or cause of decline or recovery is the manager and not "the recession" or "the economic boom" respectively.

What then are the strategies most conducive to improvements in productivity?

4.2.2 Changes in Management

Given that management inactivity is a major cause of decline it follows that strategies for improvement may include changes in management, including chief executives. This is not simply one among several strategies but probably a matter of priority. The necessary additional strategic changes and improvements in efficiency are much more likely to occur with this injection of competent "new blood".

4.2.3 Changes in Organisation

Two somewhat opposing forms of reorganisation, appropriate to different situations, centralisation or decentralisation, constitute a key strategic change on the road to improvement. Whether the firm delegates profit responsibility or uses greater centralisation of decision-making, the intention is the same, namely, to improve managerial control of unsatisfactory performance. Other forms of organisational re-design may also be called for.

4.2.4 Changes in Marketing

Another feature of the improvement process is a greater emphasis on marketing strategy. Usually the aim is to improve volume and revenue by means of price adjustment, better advertising, more skilful selling, product changes like rationalisation and even specialisation in the short term, and by new product development and extension of existing product lines in the long term. Changes in marketing strategy are related to product development in several ways: for instance, a firm might emphasise unique products and product performance, often in the anticipation that a new capability will expand customer demand. In recent years, there has been a spate of reports on various sectors of Irish business which stress the urgency of better marketing, yet action on several such reports has been slow to manifest itself.

4.2.5 Changes in Plant and Process

The development, modernisation and expansion of plant and equipment to increase capacity and productivity is a common strategy. As discussed earlier (Chapter 3), development of the production process is linked to development of the product. Strategies may include:

(a) Moves to increase the size of run or rate of output; or equivalently to reduce downtime due to plant changeover.

(b) Strategies to increase the rate of technological development. Deliberate cross-organisational and sometimes cross-sectoral transfer of staff may be a strategy. Strategies to increase capital intensity must be monitored by strict reference to relative factor prices.

(c) Strategies to introduce new products with a view to the introduction thereby of entirely new plant and processes.

(d) Strategies concerned with the development of processes and products: for example, strategies to move rapidly away from the early stages of development characterised by understandardised operations that rely heavily on general purpose equipment.

4.2.6 Vertical Integration

A less commonly used strategy where market size is limited is vertical or backward integration—that is the absorption of the production of raw materials, components or assemblies previously bought in. It has been noted earlier that the level of integration is linked to product and process development. The purpose of such a strategy may be, for instance, to control raw materials input, to facilitate the development of the main production processes, or to get a foothold in new markets.

4.2.7 Divestiture

Firms may divest themselves of whole divisions, products, raw materials or other assets largely because they cannot be profitably operated, or because management do not see a "fit" with their new definition of the firm. Ideally, divestments should be countered by the addition of new products and/or plants. It is important to note that divestment is best undertaken not as part of a major liquidation strategy, but rather to eliminate losses and cash drains—we are not here referring to major asset-stripping operations.

4.2.8 Redundancies

This, the most painful and emotive strategic move, is sometimes necessary if a company is to survive and compete successfully.

Redundancies could, however, be avoided in many cases where management inaction has led to a state of affairs where lay-offs is the only course left open for survival. Proper control of recruitment and a watch on "empire building" would have obviated the need for lay-offs in several companies known to the writers. Also, planning that takes account of normal wastage, early retirement and voluntary separation can prevent lay-offs; targets can be set to reduce the number of indirect workers over a period of time.

Redundancies often achieve productivity improvement but the political, social and personal consequences are such as to make it a most unpalatable strategy. There is a strong argument, therefore, for a much more thorough search for ways to re-employ redundant people in, say, new product development or totally new organisations.

The effects of redundancy can be dampened somewhat by retraining programmes that take account of the technical and psychological problems associated with seeking a new job.

4.2.9 Product Diversification

The introduction of fundamentally new products can be achieved in a number of ways—by acquisition, by new product development within the firm, or by joint product diversification with other firms. It has to be emphasised here, however, that the relationship between product diversification and productivity improvement is complex, as discussed in Chapter 3, Subsection 2 (b).

4.2.10 Monitoring the Business Environment and Comprehensive Planning

It seems extraordinary that whether in decline or recovery many firms do not yet formally monitor the environment of the enterprise, or thoroughly plan for the future. With regard to planning, Ian Morrison could say two years ago:

> "Many Irish firms are still not making a serious effort to plan the future of their firms. This is particularly disturbing in these times of high inflation where the ability to control the future effects of increasing costs and to estimate and provide the necessary additional working capital is essential in order to ensure survival. Where the sheer pace of growth in the monetary aspects of business gives little time for taking corrective action, it becomes increasingly difficult to avoid the dangers ahead. There is no excuse for failing to make the attempt to project profits and working capital needs at least three years forward. Inability or unwillingness to do so is to run the risk of business collapse." (Foreword to Gorman et al, 1975)

The "turbulence" of the environment is a fact of modern business life. There are economic changes—for instance, in the nature of

competition; technological changes such as the development of synthetic fibres, or electronic control of production processes; social changes, such as in the expectations and education of people, or the evolution of the consumer movement; and political changes reflected in new legislation or redistribution of wealth.

A simple exercise called "open systems planning" has been developed in the field of organisational development, whereby firms systematically try to anticipate changes in the major elements (domains) of their environment and take appropriate action. This exercise combines the environmental monitoring, and planning processes.

We include these processes in our list of strategies when, strictly speaking, they might logically have been placed in the section on techniques. However, such is the centrality of environmental monitoring and planning, and the apparent reluctance of firms to carry out these functions, that they are included as strategies, since they require fundamental rethinking and reorientation of a company's notion of what it should be doing to survive and grow. The institution of these processes in a company might well involve the setting up of a separate department in larger firms or at least a formally constituted group meeting on a regular basis in all sizes of firms.

4.2.11 Institution of an Organisational Renewal Process

Like the previous "strategic" change, this one ought to be an accepted aspect of efficient management. We include it under strategies for reasons similar to No. 8; it seems that managers commonly continue with existing strategies, policies and methods long after they are useful and until a crisis is reached. There is a need, therefore, for what we have termed an organisational renewal process through which every aspect of the firm is formally and regularly questioned. At the present pace of change the "best way" of doing things cannot be expected to remain the "best way" for very long.

In conclusion, there is no doubt in the writers' minds that the strategic actions listed above could be taken by many Irish firms right now. So the question arises as to why these options are not exercised. We can only suggest that there is wide-spread inertia, fear of the risks involved, or else ignorance about these strategies. Whatever about the inertia, there would seem to be little excuse for the fear or the

ignorance. There is a great abundance of well-documented case studies on how to make strategic changes with a good chance of success. Also, managers could learn a great deal from contact with companies which have ventured to make significant changes in strategy.

The significance of an appropriate strategy is simply this: that even the best attempts to improve efficiency will not improve performance if the company's strategy is ill-suited to present conditions.

4.3 Management Techniques for Improving Productivity

If a company has a well-suited strategy and is still performing poorly, then inefficient operations are probably the culprit. The purpose of this section is to describe briefly how operations can be made more efficient. This is not a taxonomy of management system, such as cost control, sales forecasting, etc., but rather a list of interventions that can be made to improve current systems. Occasionally, however, we do describe systems that are relatively new or seem to have a special significance in a discussion on productivity.

There are four main sections:

Labour

Materials

Overheads

Systems

This is as good a categorisation of techniques as any, but the reader should keep in mind that there is considerable overlap and interrelation among the four groups. For example, an attempt to improve the performance of operatives on an assembly line may well involve attention to materials and the use of heat and light. Where appropriate, connections are explicitly made between various techniques.

4.3.1 Labour

4.3.1.1 Introduction

In a recent survey, Irish chief executives' views on various aspects of productivity were solicited by the writers. One question asked for an

estimate of the scope for productivity improvement among three categories of labour. Their views are summarised in Table 4.1.

TABLE 4.1

Percentage increases in productivity judged possible by chief executives for three categories of staff.

Category of Staff	No. of Respondents	Range	Mean	Median
		%	%	%
Executive/Professional	85	0–100	12.8	10
Clerical/Junior "White Collar"	89	0–100	17.2	15
Operative	88	0–100	19.0	20

These impressions, however subjective, indicate the considerable room for improving the efficiency of all categories of labour. Note that in some companies the percentage improvement possible for executives and clerical staff, as well as for operatives, is 100%.

In this section we use these same three categories of labour but adopt slightly different terms to describe each one—direct labour and maintenance staff, clerical, and managerial and professional. We include maintenance with direct labour because frequently the operations they carry out are sufficiently akin to operative work to render them amenable to the same group of productivity improvement techniques.

4.3.1.2 Direct labour (and maintenance staff)

For practical purposes, we confine this subsection to techniques that are typically applied to operative level employees in manufacturing industry. As indicated elsewhere in this paper, there would appear to be considerable scope for applying many of these techniques to categories of labour other than those usually associated with the technique.

(a) *Payment Systems*

There is a general belief that money motivates people to be productive, though the complexities of the relationship between pay and productivity are enormous. A number of conclusions have been distilled by Katzell *et al* (1975) from the very extensive research on the relationship between pay, productivity and satisfaction. We quote them here in full because they constitute the best summary statement on this very complex matter:

> "1. Not surprisingly, the more workers are paid, the better they like it, the better they like their jobs, and the better their general state of mind. However, these benefits may not be due solely to the increased earnings but also to factors associated with pay (prestige, security, etc.).
>
> 2. Workers who are more satisfied with their pay are more likely to like their jobs better, and are less likely to quit, be absent, or strike.
>
> 3. Job performance is not appreciably better on the part of workers who are higher paid or those who are better satisfied with their pay (unless pay is linked to performance, as in 6 below).
>
> 4. Workers who are underpaid, relative to those with whom they compare themselves, are likely to be dissatisfied with their pay.
>
> 5. Workers who are overpaid, relative to their contributions, tend also to be less satisfied; those on piece or incentive rates are prone to restrict output.
>
> 6. Pay plans (incentives, bonuses, etc.) which are linked to performance usually generate higher levels of work motivation and higher levels of performance or productivity.
>
> 7. However, this is unlikely to be true unless the workers understand the relationship between their performance and their pay, and unless they are confident that increased production will not result in changes in the pay rates or standards.
>
> 8. Where the work requires close co-operation, group incentive plans generate better results in terms of productivity than individual incentives; however, in general, group plans do not appear to improve productivity as much as individual plans, particularly when the groups are large.
>
> 9. Satisfaction with pay seems to be greater if it is tied to performance; under this circumstance, the correlation between performance and satisfaction with pay is also likely to be greater.
>
> 10. Pay-for-performance plans are not without their problems, particularly when there is job insecurity, when there are frequent changes in markets or methods, when not all important aspects of performance can be quantified, and when there is a climate of mistrust.
>
> 11. There is little firm evidence on the effects of other aspects of compensation systems, such as schedules of payment, secrecy, etc.
>
> 12. Some of the more recent issues in compensation policy include conversion of hourly to salaried basis, guaranteed annual wage, and payment on the basis of number of different tasks learned, but firm data as a guide to policy decisions are lacking." (pp. 332-334)

An obvious general conclusion from this set of research findings is that there is no one best type of payment system. It is certainly not sufficient simply to understand the motivational significance of different pay systems. The choice of system must take account of at least four major influences:

(i) *technology*—for instance, the length of a job cycle, degree of automation or the rate of product change;

(ii) *labour market dimensions,* including such factors as annual labour turnover or the number of days required to fill a vacancy;

(iii) *dispute and dispute procedure dimensions,* such as average length of disputes;

(iv) *structural dimensions,* including the percentage of total pay settled outside the firm, number of separate trade unions

negotiating with the firm and the percentage that labour constitutes of total cost. (See Lupton and Gowler, 1969)

Lupton and Gowler have developed a method for compiling a profile of the firm on twenty-one points including the above dimensions. They then classify payment systems and indicate how payment systems can be matched with a particular firm profile.

We feel it is necessary to underline explicitly the point that the relationship between pay and productivity is influenced by many organisational and environmental factors. If payment systems fail as incentives to higher and better quality output, and if there is "decay" or "erosion" or "fiddling", these things cannot be explained away in terms of "greed", "unbridled expectations" or some other character weakness of workers. Any analysis of the causes of pay-related productivity problems must take account of the design of jobs (see Section (C) below), the management assumptions and values—regarding participation, for instance—that underlie a payment system, the process of introducing a system, the skill in administering and managing a system, the interdependence between the jobs of various employees, the quality of industrial relations, insecurity about lay-offs and so on.

To conclude on the matter of payment systems we offer a couple of practical suggestions:

(i) If a firm has not got a wage incentive scheme, it should seriously consider installing one. Recent evidence from four hundred plants in the United States shows that

> ". . . when the plants instituted work measurement their productivity rose on average of 14.6%. When plants instituted wage incentives where previously there was work measurement, productivity rose an added 42.9%. The average increase from no-measurement to incentives was 63.8%". (Fein, 1976)

(ii) If a firm's present payment system is not yielding the productivity expected then the "fit" of the system to the circumstances of the firm should be assessed. The Lupton and Gowler book indicates how this assessment can be made.

(iii) The objectives of the payment system, and the relationship between other company objectives and the payment system, should be made explicit.

(iv) Whatever is done in regard to payment systems, the values and assumptions should be made explicit. The process whereby a system is installed or changed should be carefully considered.

(v) Finally, attempts should be made to shift the emphasis away from performance standards to the necessity for continuous improvement of work methods.

(b) *Work Study and Organisation and Methods*

A prerequisite for all forms of incentive systems is measurement, that is, measurement of the methods of working, the time taken to complete an operation or whole job, and the flow of work from one stage in a production process to another. Indeed, measurement is the cornerstone of all good management and a prerequisite for defining and improving productivity.

The two principal components of *Work Study* are Method Study—which is concerned with findings the best method of doing a job—and Work Measurement—which is concerned with finding out how long a job should take. Each technique is complementary to the other, in that together they provide a systematic way of analysing and measuring activity. In this sense they form the very backbone of what was termed "scientific management". They are frequently used, not simply as a means of producing a more efficient way of doing a job, but as a necessary first step for controlling labour costs and performance, job evaluation exercises, and payments-by-results wage incentive schemes.

Organisation Study is more difficult to define, but it consists largely of applying the discipline of method study to the abstract things like the organisation's structure, policies and control.

The proper application of these and related disciplines constitutes a most significant key to productivity improvements. There are numerous textbooks on how to apply these methods to a variety of situations, so here we confine ourselves to making a number of points that need emphasis.

In much recent behavioural science literature for managers, there is severe criticism of work study and O & M, often expressed as criticism of the methods of Frederick Taylor, one of the "founders" of this approach to management and organisation. Such criticism should not sway the manager away from the value of work study and O & M. It is true, however, that the methods need to be complemented by or integrated with some of the behavioural science approaches mentioned below—such as job enrichment.

Resistance to work measurement may arise from several sources. The way in which measurement is carried out rather than what is measured is often at the root of resistance or dissatisfaction. People are naturally sensitive to being watched and timed at what they do. Considerable thought needs to be given to the whole process of preparation for and conduct of the measurement. Sensitivities and skills expressly advocated in the field of Organisation Development (see below) should characterise the work study practitioner. As a general rule, the target group of employees should have some say in the setting of standards that are based on the measurement. A number of recent papers stress this need that work study and O & M should be integrated with more human attitudes to work organisation and management.

Another matter that is worth emphasising is the need

> ". . . to divorce completely the function of setting standard time data, from the function of using the data as a basis for schemes relating to payment, costing or planning". (Randall, 1969, p. 48)

Otherwise, the judgement of the work study officer may be clouded and/or friction may occur because of the confusion of the measurement process with the application of incentive schemes.

It needs to be stressed that measurement in itself can directly improve productivity. Fein's research (1976) found an average rise of 14.5% after the institution of work measurement. It has been well established that concrete evidence of how one is performing is itself a motivator towards improvement. Concrete knowledge of results of feedback is impossible without measurement, and ways of providing this information vary from individual self-monitoring to monitoring by a group or by a supervisor.

Finally, an interesting comment:

> "Much has been written about the dramatic rise of Japanese productivity since World War II, from the standpoint of the country's work ethic and the industrial management styles. What has been overlooked is the important contributions that stem from emphasis on industrial engineering techniques that have been available to every nation." (Sakamoto, 1977)

For managers, the practical conclusions of this subsection for productivity improvement are:

(a) If work measurement or method studies of operations have not been conducted then they should be tried.

(b) If people are having difficulty accepting work study of their jobs, then maybe the whole approach to the matter needs to be humanised. This may be quite difficult, involving a considerable change in managerial philosophy and practice.

(c) See that your work study people are trained to appreciate some of the concepts and strategies of Organisation Development.

(d) Keep the process going on a continuous basis, always seeking better methods.

(c) *Behaviour Science Techniques*

In a recently published book (Cummings and Molloy, 1977) there is a systematic review and critique of the most popular behavioural science techniques for improving productivity and job satisfaction. The techniques reviewed with brief definitions were as follows:

Autonomous work groups—work structures where members regulate their behaviour around relatively whole tasks. The focus of the work design is interdependent task groups—for example, the work of a hospital ward, or a ledger department in a bank, or a production unit, or an office of a government department—rather than individual tasks, and task control is located within the group rather than external to it.

Job restructuring—which essentially involves embodying in a job more autonomy or discretion, knowledge of results, opportunities for

achievement, recognition, variety, and opportunities to learn and develop.

Participative management—which is an approach for increasing the amount of participation by workers in those decisions that directly affect the work they do.

Organisation-wide change—which is a work-improvement programme where the unit of analysis and change is the total organisation rather than individuals or groups. This approach typically embodies many of the other techniques listed here.

Organisational Behaviour Modification—which involves little more than systematic monitoring of one's work and receiving a reward, usually some form of praise or recognition, rather than money. The simplicity of this technique is disproportionate to its proven efficacy.

Flexible working hours—which is an arrangement whereby employees have a degree of freedom in choosing the hours they will work each day.

TABLE 4.2

The Percentage of Case Studies Reviewed Indicating Gains in Productivity—Related Variables*

Technique	Quantity of Output	Costs	Quality	Withdrawal i.e. Absenteeism Turnover	Attitudes
Autonomous Groups	93%	88%	86%	73%	70%
Job Restructuring	54%	32%	51%	21%	64%
Participative Management	57%	14%	14%	57%	57%
Organisation-wide Change	57%	14%	29%	29%	71%
Behaviour Modification	50%	50%	17%	50%	17%
Flexitime	83%	?	17%	67%	100%

*The subjects who participated in these projects included all levels and types of jobs. The vast majority, however, were operatives or people in low-level clerical or service jobs.

Table 4.2 summarises the effects of the various techniques on productivity-related variables, namely, Quantity of Output Costs, Quality and Withdrawal, and Attitudes to work or satisfaction. In the review by Cummings and Molloy the validity of the claims made regarding these improvements were thoroughly checked. The conclusion to be drawn from this investigation is that whatever the current limitations and uncertainties regarding these approaches to improving productivity, the pattern of evidence is compelling that they work. They do improve productivity. The same conclusion can be drawn from other recent reviews of behavioural science approaches to improving productivity and quality of life at work (see, for instance, Taylor, 1977).

The writers of these papers take the view that it is time that Irish managers discarded any scepticism they have about the relevance of applied psychology in their firms. A step-by-step strategy for implementing the above-mentioned approaches to productivity improvement and a method for integrating the adoption of several of them is spelt out by Cummings and Molloy and elsewhere in the expanding literature on the topic. (See, for example, Katzell *et al*, 1975).

(d) *Techniques especially applicable to maintenance labour*

The contribution of maintenance staff to productivity is crucial in two respects. First, there is the cost of the maintenance department itself and especially the cost of the workers who are typically highly qualified in various trades and crafts. Second, where there is poor maintenance—for instance, if there are excessive breakdowns—the direct workers are not optimally employed.

The techniques cited in this subsection are not much different from those already listed as applicable to direct workers but it is useful to mention them again very briefly in the context of maintenance management in general. It is necessary to distinguish true maintenance (i.e. repairs, routine servicing, emergency action, housekeeping (such as painting) and replacements) from project maintenance (i.e., additions, modifications, re-arrangements, removals and demolitions, and experimental setups) and service activities (i.e. operation of heat, light, water, etc., security, storeroom and materials handling). In each of the three categories a variety of techniques can be applied to reduce costs by:

Increasing manpower utilisation: This is accomplished by the use of work orders, pre-planning, pre-estimating, scheduling and backlog records. All of these are designed to ensure that the craftsmen work more of the time. Statistical work sampling can be used to measure the proportion of their time they actually spend on the job;

Reducing non-productive efforts and using better tools and methods: Work study and O & M techniques are widely applicable to achieving these objectives;

Increasing worker output: A combination of the methods just mentioned plus the use of standards and pay incentives contribute to increased output. The behavioural science techniques listed in the section on direct labour are also applicable to maintenance departments. There are several case studies which document performance improvements in maintenance departments through job restructuring and autonomous groups.

Other management actions are possible in the areas of true maintenance. First, reduce the amount of maintenance work that has to be done—by eliminating unnecessary work, improving the quality of workmanship, taking preventive action, reducing the abuse of equipment and improving the design of equipment. Second, reduce the total cost of manufacture including maintenance; the aim is to have more maintenance (at higher cost) which may actually result in lower total costs. The optimum level has to be carefully established.

Concluding Remarks

The techniques mentioned in this section have enormous potential for improving productivity, yet they are not nearly as widely applied in Ireland as they could be. For example, Gorman *et al* (1975) established that more than a quarter of large (500+ employees) manufacturing firms, 40% of medium (100-499) firms and 56% of small (25-99) firms do not have bonus schemes. They also established that about a quarter of large firms, slightly over half of medium-sized firms and six out of seven small firms do not use standard times and standard methods based on formal application of work study. There are no figures available for the use of the behavioural science techniques, but we

believe that the number of firms using them is very small indeed. With reference to the maintenance area, almost half of the large firms, more than 80% of medium-sized firms and nearly all small firms did not use work study on maintenance jobs. Furthermore, it was established that about a quarter of medium-sized firms and over half of the small firms had no documentation for monitoring the extent to which each major piece of plant and equipment was utilised.

The scope for productivity improvement in Irish industry by means of the techniques described here must be very considerable indeed.

4.3.1.3 Clerical Staff

A major and largely untouched area which offers scope for big gains in productivity improvements is clerical work. In the discussion here we include both the clerical component in manufacturing industries—in which case clerical staff are often considered as an overhead or as "indirect workers"—and the clerical staff of civil service, banking, insurance and other service organisations—where clerical staff are more properly considered as "direct workers". The types of work in each case are roughly the same and the appropriate productivity improvement techniques apply in both types of situation.

The importance of productivity in the clerical area, which, by comparison with the production area, has been relatively neglected, is borne out by what one writer refers to as the "white collar explosion" (Harvey, 1976). Bannon *et al* (1977) summarise the growth of white collar jobs in Ireland as follows:

> "Between 1961 and 1971, one to every three new jobs in manufacturing industries was an office job, while in the Service sector eight out of every ten additional jobs were office jobs" (pp. 86-87)

Harvey provides the following picture of trends which are presumably occurring in Ireland on a similar scale to that depicted—

> "All industrial countries reflect the bias in employment to the service economy. The United States is well out in front. Already 60% of its workers are employed in services including wholesaling, retailing, finance and government. Europe is following suit. In the EEC's first decade, service sector employment climbed from 34.5% to 40.2% of the total.

White collar explosion. In the UK in 1921, office workers represented a mere 6% of all workers. In 1961 the proportion had risen to 13%, or nearly three million. The explosion was under way.

According to the economic activity analysis based on the 1971 census published at the beginning of this year, the percentage of office workers virtually doubled by 1966 to nearly $5\frac{1}{2}$ million or 22%, of the total. By 1971, the proportion was 24%.

While these figures apply to employment throughout the economy, a parallel movement was recorded in production industries. The number employed on production work fell from 6,395,000 to 5,079,000 between 1966 and 1971. At the same time, there was a marked increase in administrative, technical and clerical workers. In manufacturing industry, these three groups accounted for 17.9% of the total employed in 1948. By 1974 they were 27%.

Although the cost of non-production activities is rising proportionately, there are no hard figures to show just how large a slice of an industrial firm's expenditure they represent. But US figures provide wise comfort.

A recent study of office costs at the Stanford Research Institute showed that, typically, office costs in an industrial company amounted to between 20-30% a few years ago. Now they are closer to 40-50%." (p. 29)

(a) *Work Study and O & M*

Method study has been applied to clerical work and office procedures somewhat more than has the technique of work measurement. The main reason is that it is generally felt that, while methods of clerical work could be systematically studied and improvements made, to assign reliable times to the job a person does involves a more difficult judgment. Nevertheless, considerable progress has been made in developing the technique now commonly called clerical work measurement which quite successfully assigns standard times to a variety of clerical jobs. It must be said, however, that work measurement is most easily applicable to typing pools, punch card

operating, addressing sections, sorting cheques and other simple operations. More complex clerical jobs are not so amenable to measurement, but neither are they beyond the scope of measurement, at least in some crude form. Even a crude measurement, arrived at by, say, a group of experienced supervisors is better than no measurement at all.

The uses and advantages of having clerical work measured are as follows:

> Work can be planned to ensure a fair work load, to cope with peaks in the flow of work, to control overtime and so on.
>
> It becomes more feasible to cost clerical work and to budget for and control it. Method study and work measurement will yield information on the cost and usefulness of forms, on the use and value of office equipment, and on the relative costs of using a telephone as compared with writing a letter.
>
> Manpower planning and the manning of operations is facilitated.
>
> People can get concrete knowledge of results (or feedback) on performance—which is a most important motivator.
>
> The information provided by work measurement and method study is necessary if flexitime is being considered.
>
> The study of organisation, allied to work study, will frequently reveal the possibility and advantages of redesigning jobs and reorganising work groups.

It is not common to use work measurement (time study) as a prelude to installing incentive schemes in clerical areas, although Randall (1969) reports that incentive schemes have been applied successfully to the simple types of clerical work, like typing pools or punch card operating.

The potential for productivity improvement through the application of clerical work measurement techniques is borne out in some recent articles on the subject. Harvey (1976) reports "efficiency gains" of "around 20%". The same author in another article (1976) produces evidence that

> "In one department a straight 30% improvement in productivity was gained by reorganisation which cut out unnecessary paper shuffling". (p. 36)

He also reports that

> "The typing pools were able to improve their productivity by an average of 100%". (p. 36)

Another study, Tavernier (1976), reports that a Dutch insurance firm used clerical work measurement to make considerable productivity improvements

> ". . . without dismissing a single worker. Between 1971 and 1975, premium income and investment revenue rose by over 73% to exceed $1 billion a year, while the workforce remained steady at 5,500. The 52% increase in staff costs in the period was mainly the result of wage increases. Last year revenues rose by 22% from 1974 levels but staff costs increased by less than 5%". (p. 17)

(b) *Programme Measurement System*

Work measurement has typically been applied to the more repetitive clerical tasks though there are examples of its extension to somewhat more complex clerical jobs. Another technique, called Programme Measurement Sysem (PMS) which is closely related to work measurement would probably apply more readily to the latter types of job.

> "The basic part of the PMS is the programme unit, which is an output-oriented statement of a final product (or service). . . . The programme unit may entail only one procedure or it may be the final step of a number of procedures which result in the end product", (Anderson, 1976, p. 40)

Average times for performing the programme unit are established, but not by the stopwatch—rather employees keep track of the blocks of time that seem appropriate for a given task. The unit of analysis and the standards set in PMS are less precise and detailed than is characteristic of work measurement.

Other features of PMS are the high level of participation in the whole process by all levels of staff, the relatively small amount of reporting and record-keeping required and the concentration on goals rather than means.

There are no reports to hand of the efforts of PMS on productivity, but it is mentioned here as a potentially useful extension of work measurement.

(c) *Clerical Aids and Materials*

This loosely defined group of techniques involves the application of highly specialised expertise in form design, office machines, mechanical aids, office systems, paper and other materials. There is no doubt that the various devices and systems now on offer from manufacturers and consultants can make major improvements in output, facilitate speedy retrieval of information, and so on. The improvements in output need to be rigorously assessed against the cost of the innovation in the office to ensure that productivity is genuinely improved upon.

(d) *Behavioural Science Techniques*

All of the behavioural science techniques listed in the previous section on Direct Workers are applicable to clerical and administrative departments, perhaps to an even greater degree than to the former. This is true especially in cases where the clerical worker is not tied too closely to a piece of machinery. The behavioural science techniques are particularly suitable for higher level secretarial and administrative jobs.

Several of the cases reviewed by Cummings and Molloy (1977) were in fact cases of change in clerical and similar level "white collar" jobs.

Autonomous groups are specially applicable where there are pools of labour, for instance, typing pools, large numbers of punch card operators or telephone operators, and where there are small departments containing several different similar-level jobs, as in the ledger department of a bank, the accounts department, or the estimating department of an engineering company.

Job Enrichment is applicable in the above mentioned situations and also in jobs where people work largely as individuals, for instance telephone sales staff, a receptionist, or a customer complaints clerk.

More than any other behavioural science (or even Work Study) technique, *Flexible Working Hours* has been applied to clerical work. The growth of FWH as a means to increasing satisfaction and productivity has been quite extraordinary. In some European countries

up to half of the staff in the Public Service are on FWH and it has been extensively applied in insurance and similar service institutions.

Summary
The rapid growth of service industries and of the administrative/clerical component in manufacturing industry underline the importance of the role of clerical labour in productivity improvement. Relatively few Irish organisations attend to clerical productivity to anything like the same degree that they address the productivity of the operatiave (see Gorman *et al*,1975). The scope for productivity improvement in this area is enormous. It can be achieved by the application of work measurement and related techniques, attention to aids and materials, and by the application of combinations of behavioural science techniques. Our recommendations are that managers should:

- Pay more attention to this important aspect of productivity;
- Make some initial estimates of costs and measurement of the work in the area, however rough and subjective;
- Familiarise themselves with the principal techniques;
- Experiment with some changes.

4.3.1.4 Managerial and Professional Labour

Under this heading we include managers, supervisors, sales executives and professional staff, such as accountants, barristers, engineers or industrial chemists. Professional staff may be employed in a professional practice or in the staff functions of a manufacturing or service firm.

The reason for grouping such apparently diverse types of labour together is that their work is difficult to quantify in most cases. How does one measure the output of a senior civil servant, a personnel manager or a county engineer? It is true that certain performance figures—such as sales data or production figures—can be cited as evidence of managerial or professional performance. But in these cases, the question still remains as to whether or not the person in question is functioning in the most effective and efficient way, and also whether there are some more elusive, qualitative dimensions of good performance. The difficulty of measuring managerial and professional

performance is probably one reason why the notion of productivity is rarely applied to these categories of labour. Apart from the difficulties of measuring performance, many managers and professionals would probably resist measurement of their productivity. Despite these limitations, quite a number of techniques have evolved to improve the productivity of people whose jobs are difficult to quantify.

(a) *Behaviourally-Based Performance Appraisals*
The essence of this relatively new type of appraisal system is that it succeeds quite well in expressing concretely (i.e., in measurable terms), such managerial qualities and goals as initiative, creation of a good "climate", establishment of good client relationships, professionalism, reliability, and so on. By a process that takes about two days to complete, a set of scales can be constructed to measure performance with a reasonable degree of objectivity. The importance of these scales *vis-à-vis* productivity is that they facilitate the setting of concrete targets in aspects of managerial and professional work (such as those listed above) which hitherto have been too elusive to pin down. Monitoring of performance then becomes possible. In recent years a small number of Irish companies have seriously adopted this technique for improving the performance of managers and professional staff.

(b) *M.B.O.*
Perhaps the best known of the techniques in this section is M.B.O. (Management by Objectives) which is a management process whereby organisational goals (such as "increase sales by 10%") are set and also subsidiary goals for particular departments or individuals. The achievement (or not) of those goals is regularly monitored. The differences between M.B.O. and the previous technique are that M.B.O. typically concentrates on the quantifiable aspects of performance, such as sales or production figures; and M.B.O. pays relatively little attention to the specific types of behaviour that are more or less effective in achieving the results. Clearly, then, M.B.O. and Behaviourally-Based Appraisal Systems complement each other in fostering managerial productivity. It is stressed that both techniques could be readily applied to a very wide range of professional jobs and not just the job of manager.

(c) *Time Management*

A very simple but powerful technique for improving productivity among this category of labour is time management. To apply this technique, an individual simply keeps a diary for a few days on how he spends his time. On the basis of the data accumulated time-wasting activities may be identified and dropped, priorities may be rearranged, and goals set for generally better utilisation of time. Willatt (1973) quotes the chief executive of a Swiss watch-manufacturing firm as saying that when the firm proposed introducing flexitime the managers resisted it on the grounds that they needed their secretaries all day and could not have them keeping irregular hours. However, when the managers kept a diary of the time they actually worked—including the evenings when they took home bulging briefcases—they discovered that they worked fewer hours than their secretaries.

(d) *Payment Systems/Compensation*

Between 1970 and 1976 the real disposable income of the Irish managers fell sharply. (See, for instance, the IMI submission on the Green paper, Table 1.) The complexity of the relationship between pay and motivation to produce has already been detailed. It is not possible to make clearcut generalisations about the effects of erosion of pay on managers' motivation without very much more research on the matter. If it can be assumed, however, that in some cases the effect is to diminish the incentive to expend effort then perhaps some suggestions made by Kraus (1969) for preserving the motivational impact of payment systems for American managers may be valid here.

Use better judgment in setting pay levels, that is, do not simply base salaries on a simple comparison with other companies but also consider, for instance, the size, diversity and complexity of the company, the relationship between pay at lower levels and executive pay, and the pay prospects of the company's executives if they were to leave the company.

Make more use of incentive systems, that is, link the increments or bonuses to performance.

Use non-cash compensation, such as special benefits.

Sharpen salary administration by, for instance, shortening intervals between salary increases, distinguishing between the "general" and

the "merit" elements of salary increases, and by explicitly recognising regional differences in pay levels.

Make better use of management resources, especially where the company is changing strategy and is faced with the need to promote, transfer or retire people. Strategic shifts of this kind ought to ensure that the best performers are rewarded.

The erosion of executive salaries, already mentioned, is linked with another significant phenomenon, namely, that the differentials between first line (or supervisory) management and the upper levels have been reduced significantly. The result is that the incentive for promotion is greatly weakened.

In making the case for better compensation for managers we have no intention of pleading that managers are special people who ought to get more than others. We emphasise in particular the erosion of the manager's pay and the disincentive effect of this trend.

(e) *Achievement Motivation Training*

This technique consists of a training programme specifically tailored to teach people to think, feel and act in ways that raise their achievement. The most widely publicised applications have been in the development of entrepreneurs in small businesses. More recently it has been applied with considerable effect in larger companies which are organised on a basis that allows (or could potentially allow) managers considerable latitude in developing their particular unit, for instance, chain stores and banks. There seems no reason why achievement motivation training could not be adapted to suit other types of organisation.

The core of this technique and the principal reason for its proven effect on improving managerial performance is that it teaches the individual the discipline of goal-setting and monitoring of performance.

(f) *Effective Meetings*

A great deal of the executive's and professional's time is spent at meetings, which are often rambling, inconclusive and repetitive. There are a number of basic skills in conducting meetings—such as controlling the time, avoiding repetition, ensuring clear conclusions and managing the "follow-through" on outcomes—which can be quite readily acquired by people who conduct or attend meetings. In addition to these skills, there is a simple exercise whereby an individual can

separate out the meetings or parts of meetings he should really attend and those he can properly miss.

(g) *Redeployment*
It frequently occurs that executive and professional staff are significantly underutilised in their present positions. A common case of this is where certain capabilities are required to start up a new firm or operation and once the project is running smoothly it no longer needs the same weight of expertise to keep it going. The writers know of several companies where an awareness of this problem led to redeployment of staff, usually to carry out feasibility studies and/or start up further new operations, new product development, etc.

(h) *Behavioural Science Techniques*
The behavioural science techniques—autonomous work groups, job restructuring, etc.—mentioned earlier have been applied successfully at managerial and professional levels. They seem particularly suitable in cases where professionals, such as research and development people, could be reorganised and managed in such a way as to allow for the exercise of more discretion, for more achievement and professional growth, and for more recognition of achievement.

To conclude this section, we return again to the problem of measuring the executive's or professional's work performance. Two recent papers advocate the use of more rigorous measurement at this level by techniques that are somewhat related to work study and O. & M. (see Ingraham and Lutz, 1974, and Laner, 1972). The assertion in both cases is that the "unmeasurable" is in fact measurable. This has been the main emphasis of this section: it is possible to analyse the actual work of a manager or professional—as opposed to the performance of his department—to ascertain just how productively they use their time.

4.3.1.5 Concluding Remarks
To conclude this extensive section on labour productivity, we suggest that managers should:

- Consider the importance of productivity.

- Acquaint themselves with the range of techniques available to them to improve productivity.
- Examine categories of labour not previously scrutinised from the point of view of productivity.
- Try to measure the "unmeasurable", however crudely.
- Put a cost on all categories of labour.
- Experiment with techniques for improving labour productivity among all categories.
- Monitor productivity improvement or decline for all groups.

4.3.2 Materials

4.3.2.1 Introduction
When the size of the material factor relative to the input factors such as labour is considered, it really seems incredible that so little attention has been devoted to this aspect of productivity. Quite apart from the cost of materials themselves, their adverse influence on labour productivity when they are not available is immense.

Due to the fact that raw material costs are so often very large—perhaps 55%-60% of total costs—their leverage on capital productivity is very considerable. A decrease of 5% in material costs may yield a massive increase in return on net assets (assuming no fall in selling price of the product). Because of the magnitude of material costs in relation to total costs, its leverage in this regard is frequently considerably greater than that of any of the other components of operating cost. This study now looks briefly at materials productivity under four headings, namely: purchasing, control of stocks; control of waste and scrap; and handling/transport.

4.3.2.2 Purchasing
Bauer (1976) notes that

> ". . . the potential rewards of better purchasing management in terms of increased profitability are high, and are available at relatively low risk. Unlike reduced investment, purchasing savings cannot threaten market growth; unlike price increases, they cannot provoke adverse government or customer reactions, and

unlike many efforts to cut labour costs, they carry no risk of union retaliation. And purchasing's potential economic impact can be dramatic compared with other points of profit leverage." (p. 77)

In view of this, the relatively low use of techniques in this area, and the lack of emphasis on skills in purchasing, is surprising. A number of writers (Davin, 1973; Bauer, 1976) have referred to the need to develop personnel in this area. Purchasing personnel are often not as well qualified as their colleagues performing other functions; and their function rarely has clearly-defined profit-oriented objectives. Timely delivery is typically the sole criterion for evaluating purchasing performance.

It would seem from this apparent lack of integration of the purchasing function within the firm, that there is a need for many organisations to look closely at its development, and the development of its management. Because the development of the function and its management is inextricably linked to the potential for productivity improvement through the use of management techniques, it is necessary to discuss certain aspects of it at this point. We list the potential areas for development as follows:

Organisation Structure: Very few firms have so far made any move to integrate the several functions involved in the planning and procurement of materials, yet organisations that have done so by the institution of a separate materials management function have almost invariably, in our experience, found that very great improvements in materials productivity are possible. To a large extent, integration of this sort is limited by the calibre and breadth of experience of the personnel currently working in the area. The Irish Institute of Purchasing and Materials Management are doing much to alter this, by promoting the following. First, there is the use of techniques specific to purchasing, such as vendor rating, the systematic use of techniques of supplier evaluation, and, the use of alternative and more imaginative buying agreements, such as contract buying. It is unfortunately the case that many purchasing functions are still viewed as "order placement", rather than "buying" functions. Second, there is the use of analytical techniques applicable to purchasing: one technique which has had enormous exposure in the literature and on training programmes, and which has been demonstrated over and over again to be capable of very significant savings, is Value Analysis.[1] The central role of cross-functional teams in Value Analysis and related techniques, and the process followed, are very much in agreement with the organisation development processes described elsewhere in this study. Yet the number of firms in Ireland employing this technique must still be very low indeed. Third, there is the development of skills specific to purchasing, for instance skills of negotiation. Fourth, there is the efficiency of the purchasing function itself, as measured by the ratio of buying costs to total purchases and the proportion of total employees engaged in purchasing.

As in all other areas, the setting of standards and the measurement of work is a prerequisite to productivity improvement. The methods advocated for clerical and managerial work measurement are applicable here, and during periods when purchasing volume is increasing, significant productivity improvements may be achieved by work measurement and methods improvement.

In summary, we would offer the following suggestions:

- Examine the role that the purchasing function plays in the organisation of the firm. If the purchasing function seems simply to be an "order-placing department", could materials productivity be improved by the provision of the explicit purchasing objectives, and by better co-ordination of the various materials control functions?
- If you have not attempted to analyse the value you are getting from your purchases, then do so, even in an informal way.
- Establish some means, however crude, of monitoring the efficiency of the purchasing function itself.

4.3.2.3 Control of Stocks

The existence of a link between productivity and investment of working capital in raw material or in-process stocks has already been noted in Chapter 3. The other aspects of the effects of stocks on productivity

[1]Defined by Raven, 1971, as "An analytical technique, designed to examine all the facets of cost and function of a product, in order to determine whether or not any item of cost can be reduced or eliminated while retaining all functional, performance and quality requirements".

include the overhead costs of controlling and storing them, and the effects on labour productivity of stock-outs. As has been noted earlier, the adverse effects of stocks on productivity increase (for the same total stock value) as the number of separate items increases, but at the same time so does the scope for flexibility in exchanging stock value for productivity, or *vice versa*.

In general, this fundamental connection between working stocks and plant utilisation—which for most systems of stock control can be determined quite accurately—is rarely, in the writers' experience, exploited by those involved. This is not helped by the fragmentation of responsibilities and interests in stocks and stock values—that is, responsibilities and interests spread over marketing, production and finance—or by the almost universal absence of objectives or any monitoring information in the stock control area.

Most of the current techniques for controlling stocks have been known and available to practitioners for many years. But the reluctance of organisations to alter existing systems is such that scientific stock control techniques still find very little application, particularly in smaller organisations—particularly when applied, for instance, to administrative stock in non-manufacturing organisations, or to service or maintenance stocks. In this section we examine the potential for productivity improvement under three headings: techniques of stock classification; systems of stock control; and siting and control of in-process stocks.

Techniques of stock classification

Most of the techniques used to ensure that control effort is centred on the more expensive and/or higher volume and/or more vital components are based on the very well-known Pareto principle (80% of material usage value is accounted for by 20% of the components).[2] The simplicity of this technique and the truly enormous effects obtainable—the writers have known applications which halved control effort and more than halved stock values—makes one wonder why every organisation with substantial stocks does not use it; yet the vast majority of Irish firms have not analysed their stocks in this way. There

[2]Stock is subsequently divided into different (usually 3) categories. Different emphases and different systems are then applied to each category. A "two-bin" system is frequently applied to the large number, low value so called C-class category.

are applications (for instance, Claycombe and Sullivan, 1975) which modify the technique for situations in which lead times and relative effects of stock-outs vary substantially from component to component.

Stock replacement systems

A study carried out for manufacturing plants in Britain (New, 1976) concluded that in many cases inappropriate stock control systems are in use, particularly systems based on fixed order points, frequently used in conjunction with fixed re-order quantities;[3] or, if the correct system is in use, then the available techniques are not being applied. New found that:

> ". . . out of 156 potential users of MRP (Material Requirements Planning) only about a third of these use a full MRP approach. Taking the very favourable view that all those plants using a computer breakdown are able to operate most of the essential features of requirements planning, less than half the plants (73) that should use such an approach actually do so. The number of plants that have recently turned to MRP is encouraging (30 in the last two years). However, it would appear that there are a large number of plants that, having decided that they do use requirements planning techniques and have done so for perhaps three to five years or more, have not in fact progressed very far from a manual breakdown of requirements. While there is nothing wrong with a manual breakdown in theory, in practice it is impossible to carry one out on anything like a reasonable planning cycle if one is to calculate a full schedule of requirements. Thus it is in fact virtually impossible to use the full MRP approach if only manual planning is carried out. The regrettable conclusion is that quite a number of plants are only fooling themselves by regarding their manual planning systems as full 'MRP'." (p. 21)

Systems in use based on Material Requirements Planning (MRP) techniques, and the availability of cheap, small-scale mini-computers which are ideal for such systems, mean that many small organisations

[3]The three main kinds of systems in use are:
(i) Order point system (usually associated with fixed re-order quantity/variable cycle).
(ii) Periodic review system (fixed cycle/variable re-order quantity).
(iii) Material Requirements Planning (MRP).

could now be making efficient use of MRP, where previously it was quite impractical.

New's conclusions were as follows:

> "Two conclusions emerge fairly clearly from the survey results. Firstly, many plants that have mainly dependent demand still use inventory control systems designed for use in conditions of independent demand. Secondly, many plants that think that they do use dependent demand principles correctly do not in fact do so because they either still attempt manual breakdown of requirements (a practical impossibility in all but the very simplest cases) or use a time grid so coarse that it is almost useless as a basis for production ordering or procurement. Despite the enormous amount of recent publicity in the technical press about MRP and its relevance to component assembly co-ordination problems, there appears to be a major communication gap between the exponents and practising managers on what exactly is true 'MRP'." (p. 32)

It would appear to us that the scope for productivity improvement through improved stock control systems and techniques is immense and almost untapped.

Siting and control of in-process stocks

The use of in-process stocks to increase utilisation of plant, to decouple one operation or machine from another, or to decouple one department from another is quite widespread in certain sectors. However, in our experience there are many instances where siting and amount of in-process stocks have not been properly planned, and where management has been unwilling to sacrifice through-put time for higher utilisation. Where in-process stocks are not present in sufficient quantity to decouple one operation (or group of operations) from another, then the use of individual incentive schemes becomes meaningless. Where demand for the finished product is erratic and unpredictable, then the absence of in-process stocks between, say, manufacture of components and assembly, forces an unnecessarily low level of productivity on the early stages of manufacture. Fundamental planning of stocks of this kind is capable of transforming a manufacturing operation, and of dramatically improving levels of productivity.

With regard to productivity improvement through control of stocks, we therefore offer the following suggestions:

> Whatever the nature of the materials you stock—and particularly if a large number of items is involved—Pareto-type analysis and subsequent stock classification will almost certainly lead to improvements, not simply in stock values but also in levels of productivity.
>
> Check the "fit" of your existing stock control system. If a system based on requirements planning (MRP) seems applicable, then consider its use carefully. If the obstacle to this seems to be the amount of clerical effort, then examine the possibility of computer assistance—either through time-sharing, or through the use of a cheap small-scale computer.
>
> Check the fundamental reasoning behind the positioning of your stocks within the manufacturing operation. In particular, question the role—favourable or unfavourable—that in-process stocks play in affecting the productivity of your firm.

4.3.2.4 Waste and Scrap

This is an area which in many firms simply receives no attention at all, but which frequently accounts for a significant amount of raw material costs. The potential for productivity improvement, therefore, must be substantial. There are three ways in which management may approach the problem, namely: prevention, control, and recovery. We feel that much could be done in each of these areas to improve materials productivity.

Action to prevent waste and scrap may frequently require no specific technique, but merely action like improved planning of supplies and co-ordination of suppliers; for instance, action to ensure that correct lengths are supplied so as to minimise waste. Scheduling of production may also assist in combining products in order to reduce waste.

Control of waste and scrap may be assisted in many cases simply by regular monitoring and analysis of scrap levels. Statistical techniques, such as the use of control charts—very commonly applied in quality control—can help to highlight when scrap rates are running out of control.

Recovery of waste and scrap may involve the introduction of new

plant for re-processing waste, either to enhance its sales value—for instance, the cleaning of metal swarf and the extraction of lubricant—or to render it re-usable—for instance, the use of finger-jointing machinery to produce usable lengths of wood from short off-cuts. The purchase of plant of this kind often involves heavy capital investment, and this explains why some smaller firms do not engage in waste recovery; but even where volume can justify such expenditure, investment in such plant is rarely made.

The main reason, we feel, that more is not done to improve productivity in this area is that firms simply do not realise the potential. Measurement, if carried out at all, is frequently only done as part of the scrap sales transaction, and not with a view to control. Here as elsewhere, therefore, we would suggest that if managers are not aware of the percentage of raw materials scrapped, if they are not aware of the minimum scrap levels they should ideally be able to achieve, and if they do not monitor scrap and waste levels, then this is an area which may be lucrative in terms of increased productivity.

4.3.2.5 Materials Handling and Transport

The total cost of storage of goods may represent well in excess of 30% (per annum) of the value of stock, and the potential for improving the productivity of stores space as well as stores labour must be considerable. We make a few general points concerning areas for productivity, improvements in storage and material handling, before moving on to discuss specific techniques pertaining to transport.

Materials handling/storage is not recognised as an organised profession, although the amount of research carried out in the area is considerable. There are very few materials handling managers as such in the country. Responsibility in the firm for materials handling, therefore, is usually divided between the production, sales, and purchasing functions. As a result, firms do not, in general, have cohesive policies on the level and type of materials handling investment, and the effects of poor materials handling facilities on productivity are often not fully realised.

In general, it is probably true that investment in both storage facilities and handling equipment is inadequate, and the options available are not widely known. The effect of a shortage of adequate handing equipment is that, rather than delay operations by waiting for

handling equipment to become available, materials are handled manually and inefficiently. Thus, an attempt to maintain high levels of utilisation of handling equipment leads to inefficient operations.

The layout of warehousing and choice of handling equipment in Ireland has tended to be conventional; techniques for higher utilisation of cheaper space would be possible in many cases: for instance, by the use of high-bay warehousing systems and special purpose equipment.

Transport problems and their associated techniques divided into those associated with initial planning, such as depot siting and fleet planning, and those associated with the productivity of existing facilities. As most companies have few opportunities to fundamentally alter their depot locations and transport fleet type and size, we restrict ourselves here to dealing with the latter area: techniques to improve the productivity of existing facilities.

A major area for productivity improvement is that of vehicle scheduling—the "trip planning problem". Manual trip planning techniques usually involve the grouping of orders geographically, and scheduling by using one of a number of scheduling rules, for example, assigning the largest vehicles to the furthest group of points for delivery. Norman (1969) found that, in his experience, many dispatchers develop distinctive and often very efficient manual methods, but points out that

> "Without doubt . . . sets of simple rules illustrated by clear examples, guide books, visual displays, means of checking performances, talks and discussions with depot personnel and drivers can achieve very worthwhile economies without recourse to computers". (p. 28)

However, the development of *Linear Programming* methods, which produce, mathematically, optimal solutions, has meant that very considerable improvements can be achieved by the use of such methods, by means of computer. Norman found that even:

> ". . . where computer programs for trip planning were tried and for some reason abandoned . . . the resulting improved manual methods invariably benefited from the precise data and logical structure required for the computer trials and some embody principles learned from, or developed during, the period of program testing". (p. 29)

The other major area for cost improvement is that of fuel economy. A number of techniques have been developed for this, and one which has yielded very substantial improvements in productivity is the *CuSum Technique,* developed for a variety of statistical control problems, and applicable to fuel consumption control in transport fleets. This technique uses statistical control methods to track the consumption of fuel and to signal when consumption is nearing an out-of control level. It must be true, however, that here as in all other areas we have discussed, the very fact of regularly measuring, and adopting some means, however crude, of controlling this element of cost must represent a large proportion of the productivity improvement.

4.3.2.6 Concluding Remarks

In concluding this discussion on materials productivity, we would emphasise that the opportunities for productivity increase in this area must be immense. Due to the very large direct cost and the sizeable indirect and overhead costs involved, the opportunities could be larger than in any other area. In view of the very large expenditures involved, and the massive amounts of money involved in items such as scrap and fuel, the lack of measurement is particularly striking. We can only suggest that if managers have not examined every element of materials and transport that incurs cost, then the potential productivity improvement is probably very great indeed.

4.3.3 Overheads

In this section, we discuss the application of techniques to improve productivity by the examination of the various services and costs not easily allocated to specific outputs, usually grouped together under the heading of "overheads". A number of specific areas usually listed under this heading—for example, clerical staff—have been covered elsewhere; and many of the techniques discussed elsewhere—work measurement techniques, cost reduction approaches, behavioural science approaches and organisation development techniques—apply to this area.

It is worthwhile, however, including a separate discussion on overheads, because with one or two exceptions, they represent a comparatively neglected area of cost control.

We outline here an approach to the examination of overhead productivity in areas where the major cost element is staff, and an approach to the examination and monitoring of energy costs.

Overhead costs are a very significant element of cost. Neumann (1975) points out that in the USA

> ". . . between 1950 and 1970, the number of workers in 'overhead areas' increased six times as fast as those in production. They now account for no less than 40% of all payroll costs". (p. 117)

Some overhead costs, especially the costs of electrical power and oil, have risen so dramatically that a great deal of attention was temporarily paid to them, and many firms discovered during and immediately following the "oil crisis" that significant reductions in energy usage could be made. However, it seems very likely that these savings, when not scrutinised on a continuing basis, have largely been lost through "drift", and a general lessening of attention to controlling them. It is also almost certainly true that the same attention has not been applied to other overhead activities. As Neumann (1975) points out:

> "In the typical company . . . one can confidently assume that every one of these activities is costing more than it ought. This is a safe assumption for two reasons: first, because the activities themselves are inherently resistant to analysis and control; second, because the normal functioning of the organisation positively encourages them to grow". (p. 117)

Liao (1975) points to further reasons:

> "Some expenses . . . are considered uncontrollable; and Management attention tends to be directed towards the quality of service rather than cost control". (p. 25)

It is true that many overhead costs are difficult to measure and difficult to control. However, such techniques and analyses as have been applied have almost invariably met with some measure of success. One technique which has been specifically developed to tackle overhead productivity is Overhead Value Analysis. As this approach embodies many sound principles for tackling overhead productivity, it is

worthwhile describing it briefly. As Neumann (1975) has been a major exponent of this technique, and as it is not commonly known, we quote him at some length at this point.

> ". . . a score of corporations in the United States and Europe, threatened by potentially dangerous cost situations, have in the past three years successfully cut their overhead costs (defined very broadly) by roughly 15% to 30%. . . . And these cuts are structural. They will stay." (p. 117)
>
> ". . . In traditional value analysis, a study team first determines what performance criteria a selected product or item must meet and then either develops a better, lower-cost design or devises an engineering method to accomplish the same results more economically without sacrificing the required level of quality. Companies have adapted this same technique to overhead functions and their costs. In an organised way, the analysis provides an efficient discipline for scrutinising all the many thousands of activities that make up overhead, identifying all the areas where cuts can safely be made, and, where high quality is a factor, providing a framework for balancing costs and estimated benefits.
>
> But overhead value analysis differs from traditional value analysis by making both the managers who incur the costs (suppliers) and those who benefit from them (receivers or demanders), responsible for identifying which costs to cut. Top management . . . make the final decisions, but they are guided by the combined judgment of the entire management team." (p. 117)

The process is described as follows:

> "If, . . . the enormous task of reducing overhead costs is delegated (in a special way) to every manager in the company, overhead can be successfully cut. All managers either request or supply overhead services, and so together they can recommend in detail which services can be pared back without damaging the organisation. By formally placing the burden of the task on all managers at once . . . overhead value analysis brings requesters and suppliers together to work on what they can see is a

common, company-wide task. In this way, managers feel freer to recommend changes.

To ensure that the recommendations are soundly based and to guide, even challenge, managers as they go through the process, stage by stage, the chief executive officer will need to appoint a small, high-level task force. Three to five task force members working full time for as many months are normally sufficient.

Before actually embarking on an overhead value analysis, it is difficult for a company to determine what the optimum low-risk/cost-reduction level is in each organisational unit or function. Inter- or intracompany comparisons or trend analyses seldom shed much light on this question, and in any case they are always open to challenge. Accordingly, to ensure that no reasonable option for cutting costs escapes examination, top management should set an initial cost-reduction target, uniform for all functions, that overshoots whatever the true potential may be.

The target that has worked best is 40%. This is a jolting figure when first announced, and admittedly arbitrary; a case has been made for varying it by as much as 10 percentage points either way. But it is not too high to be credible. True, in most functional areas attractive cost-reduction opportunities will most often fall in the 15% to 30% range. Nevertheless, savings opportunities totalling 40% or more are not unusual.

Once the target has been set, the overhead cutting program proceeds in four stages:

1. Estimate the cost of overhead end products and services flowing between organisational units.
2. Create an extensive list of options for eliminating or reducing the demand for most of these.
3. Recommend all those options whose cost savings outweigh their likely adverse consequences.
4. Decide the actual cuts to be made. This step is reserved for top management." (pp. 119-120)

The same writer recommends that before tackling a programme of this sort, the manager should be certain that he is really prepared to tackle seriously the question of overhead costs and productivity.

"Specifically he should ask himself, 'Am I prepared to do what is necessary? Would I:

commit myself to achieving a truly demanding cost reduction goal?

appoint my best managers to control the process?

refuse to accept less than the target already established?

draw sharp lines despite a lack of hard data?" (p. 125)

The techniques involved in Overhead Value Analysis apply mainly to the overhead element of which the major component is staff cost: areas involved may range from the telephone switchboard to R. & D.

As has already been noted, a sizeable element of overhead cost is the cost of light, heat and motive power. National policy in the United States now requires corporations to scrutinise energy usage closely and continually, and to some extent this has been applied in Ireland, particularly by Irish branches of U.S. multinationals. However, the concept of a comprehensive Energy Audit is comparatively new, and untried by many. We therefore describe the process briefly here.

Charles Ryder (1976), Head of Energy Conservation Technology, UK Department of Energy, advocates a three-stage approach, summarised as follows:

1 Establish good house-keeping disciplines. This stage can be implemented quickly, but requires the involvement of everyone in the company from top management down to the shop floor. Some measures at this stage may require expenditure but the return is likely to be obtained quickly, within a year or so.

2 Identify those areas where some investment is needed to effect significant energy saving—it is at this stage that an energy audit is useful. Examples of such areas might include: insulation of tanks, roofs, and pipes; recovery of heat from waste hot water or vitiated air; process waste heat recovery. Pay back on these schemes normally would be achieved within one to three years.

3 Use expert help to carry out detailed analysis of energy usage. The results of this analysis would apply to investment decisions regarding the renewal of plant or equipment, and would take into account

possible future trends of energy. The energy audit itself parallels the discipline and data collection procedures required in accounting. Its basic aims should be to find out:

(i) how much energy costs;

(ii) how and where it is used;

(iii) how much is wasted;

(iv) how and what internal and external factors cause changes in energy consumption from one month to another or from one year to another.

We would suggest that the manager should be prepared to answer the following questions:

Do you record, in a way which can be quickly checked, the usage of gas, oil, electricity, etc.?

Do you analyse and aggregate the monthly or quarterly accounts for energy?

Can you identify the areas of high energy consumption, and can you monitor their usage? (Sub-metering of electricity may be necessary here).

Do you have a regular maintenance schedule for all energy-using plant?

Have you used specialist advice where this is needed, to ensure that the cheapest and most efficient methods of heating, etc. are being employed?

Are your buildings such that energy is conserved wherever possible?

Conclusion

productivity improvement in these areas has been largely ignored in the past, or at best has been subject to infrequent and fairly indiscriminate cost "axing". When this has taken place, the method has frequently been to slash budgets in one or a few conspicuous areas, such as training or R. & D. These steps are usually regarded as

temporary measures to cope with short-term recession, or crises like the recent oil shortage; and then they do little to improve overhead productivity in the longer term. They may also have serious adverse effects on productivity elsewhere, and may even jeopardise the future of the firm by reducing its capabilities to meet future needs.

Poor productivity in the area of overheads is often highly visible to direct employees. Excessive expenditure on overheads at the same time as greater pressure is being exerted on direct costs, is conducive to hostile reactions that can have grave adverse effects, for example, on direct labour productivity. In view of the lack of concerted attempts in the past to review systematically and improve overhead productivity, we feel that this is an area capable of massive productivity increase. We feel, however, that the treatment must be systematic, demanding, carried out on a regular basis, company-wide and such that it involves the personnel directly in the area.

4.3.4 Management Systems

By management systems we mean all the systems for enabling management control and decision-making. The performance of an operation can only be as good as the performance of the system used to manage it. As these are based on the timely provision of the right data, the efficient administration of data is central to good management systems. Minami (1976) sums this up as follows:

> "The occurrence over the past decade of increased planning, automated information systems, and more sophisticated analytical tools has resulted in both the creation of more data and the increased need for more accurate/timely data. The significance of good data management to a firm's competitive posture has dramatically increased in recent years due to the capabilities of other firms to effect changes quickly via computer based processes. Data must now be considered a resource with money, people, and equipment, for it plays an important role in a firm's operation". (p. 40)

We feel that in any study of management and productivity it is necessary to include some discussion on management systems. We do not include here any discussion of systems analysis, which is associated with, but by no means confined to, the analysis of systems

with a view to computer application. It is concerned with the selection of elements, relationships and procedures to ensure that the minimum resources are used to achieve the desired objective of the system. The literature on systems analysis is very extensive; but whilst we are aware that systems concepts are extremely useful—even vital—in the critical examination of management controls, we realise that the vast majority of organisations in this country do not have access to expertise in this area.

However, the writers feel that even if relatively unsophisticated methods are employed, the area of management systems is one which should be critically examined for its effects on productivity. Our view is strengthened by a comment made by one US executive with regard to systems in UK subsidiaries (Pratten, 1976)

> "My experience in the UK has shown that where businesses have not been looked at closely for, say, five years, one usually finds drift has taken place and that productivity can be increased by, on average, 20% purely by improving management control data (e.g. work standards, booking systems, production control, etc.) and then reducing the true lost and waiting time, and excesses that the revised control system reveals."

We feel, therefore, that we should include at least a few general points about systems, the data used to operate them, and their possible effects on organisational productivity. We do not set out to examine the area exhaustively, nor do we make other than general suggestions.

Precisely because of the ever-growing ability, referred to above, to create large amounts of data, there is a grave danger of creating systems to generate information for its own sake. We refer, for instance, to accounting sections producing reports that nobody requires; to computerised stock control systems generating literally thousands of pages of information per week which no manager is capable of coping with; to circulated reports which provide accurate historic summaries but nothing else. There is a need to question constantly the need for all information generated, and the usefulness of all regular reports. Where computers are used, we feel that there are great opportunities for productivity increase in the transition from "batch" to "on-line" data processing systems. On-line systems permit the user to interact directly with the system, and to enter or extract

information at will, as opposed to batch systems in which information is fed in and reports generated, on a periodic basis, perhaps once a week. Batch processing is usually associated with centralised EDP sections—on-line systems facilitate the decentralising of computer services.

Unless the complexity of management systems is kept under constant review, there is a danger of creating systems which cost more to operate than the costs they are attempting to control. There is a need for constant project evaluation of all management systems to ensure that the most economic level of systems complexity is reached. This is an instance of the need, in some cases, to sub-optimise on the performance of some sections in order to optimise overall productivity levels.

At the same time the writers refer to the systems Law of Requisite Variety (Ashby, 1963), which, in simple terms, states that "the variety of controls must equal the variety of conditions". That is, as the complexity of an operation—for example, the complexity or size of the product range—increases, so must the complexity of the systems required to control the operation. If the revenue structure of the operation is such as to make it economically impossible to achieve this, then either limits must be placed on the complexity of the operation, or low productivity levels must be accepted.[4] We are aware of a number of Irish companies at very low levels of productivity due to violation of this basic principle.

The rapid developments in small electronic computing devices—for example, micro processors—both in terms of programability and memory capability, means, firstly, that considerable decentralisation of management systems can now take place and that very much more sophisticated control systems are possible. Considerable work has been carried out in Trinity College, Dublin, and elsewhere, in the development of mini-computers and micro processors for monitoring production processes; these are essentially reporting devices which make it possible to achieve very much higher utilisation and productivity levels than previously. This is a field which is changing so rapidly that it is difficult even for those closely involved with it to keep abreast of developments; but we feel that managers who have

[4]This law also places limits on the *rate of growth* of an organisation, and on the adoption of many of the strategies described earlier in this study.

operations requiring complex reporting and decision-making would be well advised to keep themselves informed of the technical possibilities within their management systems.

We are concerned that many—perhaps the majority of—management systems operate without objectives of any sort. This is a principal explanation of the proliferation of unrequired reports, because where objectives do not exist there is nothing against which to judge the appropriateness of information. Where objectives do exist, there is a need to formulate them with a view to overall performance—including productivity—in addition to other, lower level objectives. A very great deal of work has been carried out on this aspect of management control systems, involving what has come to be termed the *Total Systems* approach. We feel that this approach is not often used in practice. For instance, production planning and control systems are rarely geared to achieve productivity or other overall objectives. They are more usually geared to—and measured by—the achievement of objectives such as utilisation, minimisation of overtime, or stock value. Gorman *et al* (1975) found that Irish firms are significantly behind US companies in this respect. We feel that it is the task of senior management to ensure that objectives encompassing overall productivity targets are formulated for management systems.

Because of their central role, not only in the monitoring of organisation performance, but also in the decision-making processes of the firm in areas which have enormous impact on productivity levels, we feel that there is particular need to assess the effectiveness of costing systems in highlighting the areas of operations contributing to low productivity. Costing systems in general have not been installed to establish productivity levels—they are concerned with productivity in so far as they measure cost and profit. Absorption systems—by far the most common costing systems in Ireland—are particularly inefficient in the identification of unproductive areas or products. During the nineteen-sixties much work was carried out in the development of productivity costing systems, in which system operation costs are allocated to each of the system's potentially productive facilities (whether personnel or equipment) in proportion of their potential productiveness measured in productive assets values. It is probably true to say that productivity costing principles have not been adopted at all in this country.

Finally, it is vital to note that management systems in themselves must be responsive to change, and must themselves be capable of change. Good management is not simply the efficient operation of systems—it also involves changing the variables controlled by the systems, and the systems themselves, to meet changing needs. Every opportunity should be taken to question the bases on which past decisions have been taken.

Zero-base budgeting is an example of one technique which demands this approach. This involves budgeting by

> ". . . starting from base zero, viewing all activities and priorities afresh, and creating a new and better set of allocations for the upcoming budget year." (Pyhrr, 1970 p. 63)

We would recommend that a similar approach be taken on a regular basis to all established management systems; and would stress that the application of techniques to improve productivity must be complemented by adequate management systems.

4.4 Management Skills Conducive to Improving Productivity

So far we have listed and described briefly the principal strategies and techniques for improving productivity. We have referred repeatedly to the well-documented fact that these strategies and techniques are greatly underutilised in Ireland. In the final analysis any company depends on its managers to improve effectiveness and efficiency. It may be appropriate, therefore, to consider the qualities or personal characteristics of managers that would appear to be most conducive to the adoption and skilful use of the various strategies and techniques.

Readiness to experiment/innovate

There is scope for productivity improvement in all situations and a manager who is disposed to experiment—even in small ways—to tap this potential is better than one who is not.

Democratic management style

Except in cases of crisis or in the short term, it seems that an

authoritarian or impersonal style of management does not make for productivity among staff. There are many exceptions to this generalisation, but the change in attitudes to authority that pervade society today would imply that a more open, participative style of management will work better in the long run. Almost all the recent research into this topic indicates that this style of management is, in general, more productive.

Sets Objectives/plans

These skills are at the very heart of good management and are a key to greater productivity in his own work and the work of those he manages. However trite it may appear to list them, these skills—which are really a form of personal discipline—are by no means widespread. We have already referred to the relative absence of planning in industry, and the weakness extends right up to board level. A recent study of objective-setting in British boardrooms concluded—

> "The results certainly underline that the concept of formalised objective-setting is accepted within the boardroom, but any acceptance is sterile without positive implementation". (Norburn, 1974, p. 17)

Perspective

Many recent writers on productivity note that a major failure of managers is to focus on too few variables or indicators of performance. They advocate what some would term a systems view, which really means looking at any set of figures in a wide organisational and environmental context, and also looking a few years into the future.

Diagnostic/Questioning ability

Associated with the previous characteristic is the ability to see beyond stereotypes or plausible explanations for events. For instance, to blame high absenteeism on the character weakness of workers or to blame poor profits in recent years on the "oil crisis" or "the recession" are clearly inadequate explanations. Remedial action can only be taken where there has been detailed diagnosis and penetration beyond the cliché.

Monitors performance closely

A corollary of diagnosis and objective-setting is the readiness to track performance. Among other things, this requires a high regard for recent data. Very often, things may have changed by the time the manager knows what is (or was) going on. There are countless examples of problems which could have been "nipped in the bud" by early monitoring.

Cost consciousness

This is another quality one would expect in any manager or professional, but which is not in fact widespread. Many managers are obliged to operate financial control systems (including control of costs) and they do so quite successfully but this is quite a different quality from the readiness to question constantly the costs incurred and a preparedness to make cuts before the cost-incurring functions become (apparently) indispensable.

Tough—mindedness

This quality is neither the same as an authoritarian nor the opposite of a democratic style; it simply represents the ability to make an objective assessment of things and mature decisions about them. Some managers and professionals are hamstrung by the croney system, fear of departing from the *status quo,* and other similar restraining emotions and attitudes. These phenomena are at the root of decline, particularly continuous decline over a long period and, while they have been often mentioned in reference to family businesses, they are by no means confined to this general category of enterprise.

Facility in making decisions

If you ask almost any manager whether he has put important matters on the long finger he will answer in the affirmative. The so-called "dynamic" manager or professional is one who, among other things, can somehow get things done by bringing a speedy closure to matters outstanding. He does not carry around in his head a lot of "unfinished business" which bothers him and distracts him from what he ought to be doing at any given time.

4.5 Organisation-Wide Approaches to Improving Productivity

4.5.1 Introduction

We have so far categorised management leverage for improving productivity under headings of strategies, techniques and skills. There are some additional means which cannot easily be fitted into any of these three categories because in a sense they embrace all of them to varying degrees. These additional techniques are not, however, a lumping together of several discrete techniques, rather the techniques we now mention are characterised by a systems approach (that is, all aspects of a whole unit or organisation are kept in focus). They feature a process that ensures productivity is tackled in a comprehensive fashion, with sensitivity to the "human factor" and with continuity over an indefinite period of time.

4.5.2 Scanlon Plan

Perhaps the most sophisticated approach to productivity improvement in existence is the Scanlon Plan, which has three main aspects to it. The philosophy or motivational theory of the plan is that the average person is both able and willing to make important contributions to the solution of problems and to other activities normally considered to be the preserve of management.

The participative mechanism of the plan, namely, the "production" committees and the "screening" committees are designed to elicit, evaluate and decide on implementation of suggestions for improving productivity. The productivity formula and bonus of the Plan are a means of calculating the contribution of implemented suggestions to productivity improvement and of rewarding all participating employees (managers, secretaries, operatives and others) with a bonus for the improvements. Cummings and Molloy (1977) have described the Plan in detail and indicated where it can be most suitably installed. They emphasise that considerable preparation—in most cases extending over several years—is required before formal installations, and that in particular the adoption of the Plan demands a genuine and enduring belief by management in the value of employee participation and profit sharing. There are one or two excellent examples of the operation of the Scanlon Plan in Ireland and, given the typical size of Irish companies, it could be extended to many other companies if the will to do so existed.

4.5.3 Cost-cutting Programmes

Cost reduction is not the same thing as cost control. Many companies are satisfied with more or less elaborate systems of cost control but neglect true cost reduction techniques. The distinction between the two is that

> "Cost control is concerned with reducing costs to the level of established standards. Dynamic cost reduction is concerned with lowering established cost standards." (Roth. 1974, p. 33)

Roth lists a number of techniques for identifying the areas where cost reduction should be concentrated:

(a) *Distinguish major costs from minor,* and concentrate on the former. It makes a little sense to look at paperclips if labour and heating are major costs.

(b) *Pareto's principle*—focus on the vital few people, machines, operations (or whatever) that account for the major costs rather than on the larger percentage that account for relatively little.

(c) *Controllable versus non-controllable costs*—concentrate on costs that are said to be controllable, but also raise the possibility of controlling those said to be non-controllable. Every cost is controllable at some level in the organisation, or at some time.

(d) *Fixed versus variable costs*—Roth notes that

> ". . . expenses in the fixed categories which generally are regarded as not susceptible to cost reduction can, in fact, be made to become like variable expenses from the viewpoint of cost reduction". (p. 35)

(e) *Unit costs*—generally speaking, as volume increases from a given man, machine or building, the fixed unit cost will decline and the variable unit cost will remain fairly static—with consequent decline in unit costs. So try to obtain greater output from existing resources.

(f) *Static standards*—re-evaluate budgeted standard costs that have remained static over a period of a couple of years (or even less in some cases).

(g) ***Budget variance***—excessive or continuous variances, either positive or negative can indicate potential for significant cost reductions. Positive variances may point to the need for remedial action, whereas variances may point up opportunities for even greater savings in the same situation or applications to other areas where savings could be made.

(h) *Profitability analysis*—essentially, this technique involves making available financial statements on the profitability of departments, products or some other appropriate unit of analysis.

(i) *Make versus buy*—many organisations could reduce costs by buying in some of the components, expertise, operations, etc. that they currently retain in the organisation. Of course, there are cases where it would reduce costs to do precisely the opposite.

(j) *Standardisation*—scope for standardisation of methods, paperwork, products, etc. should be examined.

(k) *Inter-company pricing*—transfer, or inter-company pricing should ensure that internal operating results do not create an impression of poor results for efficient units and good results for inefficient units. This problem may be found in companies organised on a profit centre basis.

(l) *Competitive analysis*—it is argued elsewhere in this paper that comparisons should be made with other companies in the same sector. Comparisons which can be readily made from public information are useful. (See Appendix 1).

These and similar analytical techniques greatly assist in focusing on the areas with most potential for cost reduction. The question remains as to how best to get action on cost reduction once the above techniques pinpoint potential reductions. There is no blueprint for cost reduction to suit all companies, but the following suggestions have been culled from a review of several recent case studies (Togna, 1977; Howe, 1977; Clutterbuck, 1977; Willcoxon and Brocato, 1976, (a), (b)):

(i) ***Appoint a senior manager*** with responsibility for cost reduction (or, more broadly, productivity improvement). Alternatively, have senior management formally establish a cross-functional group to take responsibility.

(ii) *Engage everyone in the process*—the process needs to be carefully designed, but it should include everyone in the unit or organisation in question. Ensure a team approach.

(iii) *Obtain the necessary information and analyse it,* perhaps using some of the techniques mentioned above but also drawing heavily on the intuition and experience of everybody.

(iv) *Focus on priorities*—try to isolate the few significant areas and concentrate on these.

(v) *Divide up and delegate* the work to be done on cost reduction.

(vi) *Set targets*—this should be done in a participative way.

(vii) *Monitor performance*—keep even a crude check on progress.

(viii) *Formally acknowledge* the improvements (or failures to improve).

(ix) *Repeat the process regularly.*

It would be seen that part of the secret of success with cost cutting programmes, such as those espoused here, is the relative informality of the process.

4.5.4 Organisation Development Techniques

Organisation Development (O.D.) has been defined as

> ". . . an effort planned, organisation-wide, and managed from the top, to increase organisation effectiveness and health through planned intervention in the organisation's 'processes', using behavioural-science knowledge". (Beckhard, 1969, p. 9)

The Scanlon Plan and some of the behavioural science techniques listed in the subsection on Direct Labour constitute O.D. techniques, but O.D. embraces several other approaches which have potential for improving productivity. These other techniques, such as team-building or survey feedback will not be detailed here, rather we indicate the distinctive features of O.D. that can contribute significantly to any attempt to improve productivity.

(i) *O.D. is specially sensitive to the human factor* involved in organisation change, including technological change. The training

of O.D. specialists typically concentrates very heavily on the development of personal acuity and skill in interpersonal relationships, group dynamics, etc.

(ii) *O.D. has a great deal to say about the strategy* or process of change. It strongly advocates careful design of any intervention to improve productivity (or achieve any other given purpose).

(iii) *O.D. has made great progress in refining the art of engaging people,* that is, in getting people really to participate in and take responsibility for an organisation's improvement.

(iv) *O.D. of its very nature is reflective and questioning.* It thus constitutes a spur to continuous renewal and an antidote to getting into a rut.

(v) *O.D. is alert to the environment*—it sees the organisation as interacting with its environment and provides ways of analysing how the organisation can best cope with its present and future environment. Thus it constitutes a crucial stimulus to change in company strategy.

(vi) *O.D. formally attacks the norms, structure and roles of bureaucracy*—that is bureaucracy in its worst sense. It seeks, for instance, to establish that competence rather than position or title be the basis of power, and to replace competitiveness with collaboration, where this is appropriate.

(vii) *O.D. is founded on the systems approach*—it thereby attends to the organisation as a whole, that is, all important data: something which we have advocated throughout this report.

4.6 Concluding Remarks

In this chapter, we have listed the wide array of management strategies, techniques and skills for improving productivity. The position is taken that the management of productivity improvement is both an art and a science. As a science there was repeated reference to the need for measurement, planning, goal-setting and review and on the need to consider all relevant variables. As an art we referred to the place of intuition, ingenuity, perspective and sensitivity to the fact that people are involved at every point. We have argued, very strongly in

some instances, that the scope for productivity improvement is enormous. We firmly believe that the main obstacle to tapping the vast potential for productivity improvement is attitudinal—some managers are disposed to taking the necessary steps, while others—who may even know all about the various techniques and strategies—are not so disposed.

CHAPTER 5

CONCLUSIONS

5.1 Introduction

The position has been taken in this paper that the scope for productivity improvement in Irish organisations—in industry, education, health, the public service and elsewhere—is very great and that managers and administrators have considerable leverage for tapping this potential. If such is the case then the question arises as to why the necessary changes do not occur—which leads us to consider the barriers to productivity and some related matters that need to be urgently addressed.

5.2 Employment and Productivity

Productivity improvement is sometimes achieved at the expense of layoffs and there is no doubt that many more public and private companies could achieve gains in output, using current technology. It needs to be emphasised, however, that in such cases layoffs need not necessarily ensue. The challenge is to create new employment from the higher volume and profits generated by better productivity. The emphasis needs to be placed on productivity improvement measures aimed at expanding markets and increasing volume.

There is no substitute for high productivity. The permanence of jobs depends on it. Wherever a firm continues with low productivity it is storing up trouble for all concerned.

5.3 Technology and Manning Levels

Technological change constitutes a major key to productivity improvement because, generally speaking, several factors, including the availability of consultants who know the new technology and are skilled in the process of transferring it, determine the speed at which a new technological possibility is translated into a reality. Clearly, the

availability of capital is another factor. A particular problem stems from the fact that companies with high productivity and profitability can generate the capital for new plant, whereas those who are not doing so well can get caught in a downward spiral.

Barriers to technological change include resistance to the very introduction of the new machinery, refusals to allow the reorganisation of work processes, refusals to move to new locations, retention of outmoded incentive schemes, insistence on artificially low standards, restrictions on subcontracting, retention of higher manning levels than are required and so on. An American study (Hershfield, 1976) reveals that these obstacles are very widespread in the US. We do not know precisely what the picture is here in Ireland.

5.4 Productivity outside the Industrial Sector

There is enormous scope for the application of the techniques mentioned in this study to types of jobs and organisations not usually considered targets for productivity improvement. We have already referred, for instance, to the application of work measurement and behavioural science techniques to the whole area of clerical work. But these and many of the others listed could be readily adapted to improve the productivity of our cities, courts, hospitals, universities, the research and development institutions, the gardaí, county councils, government departments, professional offices and a host of other organisations. It is probably still taboo even to mention productivity with reference to some of these institutions. Hence the need for more open debate on the topic.

5.5 Productivity and the Public Sector

Most of the comments made within this report apply equally to the public sector. Notions of productivity and the various techniques discussed in the report are equally applicable to clerical jobs, county council workers, the courts, senior civil servants, board of works employees, etc., as they are to the job of operatives in manufacturing industry. Within the public sector, however, the approach may be somewhat different:

> "... the pre-conditions for translating into practice the 'principles of best management practice' may take more account of the susceptibilities of those whose efficiencies will have to be improved than would typically occur in the private sector". (NESC, 1976)

Also, the problems in achieving productivity improvement may be quite different:

> "Where competition is keen survival depends on reducing costs by improving productivity and efficiency. The external pressures from market forces that can operate in the private sector may be replaced in the public sector by dedication and commitment (which may also be strong in the private sector). However, these motivations need not necessarily work towards minimising costs in the same way as do market pressures". (NESC, 1976)

It is acknowledged that the Department of the Public Service has played an important role in increasing efficiency within other Government Departments and Agencies.

> "However, the experience following the report of the Public Service Organisation Review Group (the Devlin Committee) would not suggest that internal initiatives would by themselves be sufficient . . . 'a key prerequisite will be . . . the continuing interest and active involvement of Parliament, Government, and individual Ministers in this field'." (NESC, 1976)

The fact that the level of efficiency of areas of the public sector (for example, communications) impinges so directly on private organisations means that, at least to some extent, the productivity of the private sector will be affected by that of the public sector.

5.6 Management and Organisational Weaknesses

The main focus of this report is on the role of management (in all types of organisation—public and private) in productivity improvement, and it was stated earlier that the principal agent or cause of decline or improvement is the manager. Weaknesses in management, therefore, constitute a very significant barrier. Some salient points in this regard are:

- *Ignorance of the techniques available* to improve productivity.
- *Inertia,* even in the face of continued decline.

- Stereotyped, simplistic thinking about the causes of, and remedies for, low productivity.
- *Confusion* between good management controls and genuine productivity improvement programmes.
- Policies of *promotion from within* which prevent the influx of new blood that has been the key to revival in many firms.
- Gross lack of appreciation of, or ability to harness the potential contribution of all staff to productivity improvement.
- Failure to act on reports and research that specify how productivity could be improved—recall the many reports on reform in the Public Service, marketing our food produce, industrial relations, rationalisation of particular industries, etc.

The solution to some of these problems is more training, but there is also the fact that even when managers have learned a technique or strategy they are either forbidden or unwilling to apply it. The transfer of training remains a formidable problem and merits the attention of the training institutions and the companies themselves.

Closely associated with management weaknesses are weaknesses in organisation, that is, features like centralisation-decentralisation, the number of levels in the organisational hierarchy, the design of jobs and so on. Features of design affect communications, ease of decision-making, internal mobility of staff and other determinants of productivity. Organisational design has become a specialised and rapidly evolving field of expertise, and merits the close attention of managers.

We have referred to the lack of planning and monitoring of the economic environment repeatedly in this study because it constitutes a major barrier to improved productivity. Unanticipated and unplanned-for costs are a source of difficulty to some firms. Planning of purchasing, of insurance, of manpower and of practically every other aspect of a business, can greatly help to reduce costs and raise output. Associated with planning is the need to be alert to the environment of enterprise—to changes in legislation, to the consumer movement, to changing tastes and aspirations, to political changes, changing competition, and so on. If managers were to ask themselves what signs

were evident five to ten years ago of pending changes in the environment they would recognise that many factors now adversely affecting their business were then patently obvious. One striking example of "writing on the wall" was the advent of Ireland's membership of the EEC and all its concomitants—factors which many firms did not adapt to sufficiently early.

Finally, on management and organisational weaknesses, the responsibility for productivity improvement within companies is usually dissipated throughout several different functions. Productivity improvements is not the same as production management or financial control, to mention just two functions. Some companies have begun to develop their work study departments into "productivity services" departments, and this is a move in the right direction. As things stand at present, many companies have no clear focus on productivity, and no formalised productivity improvement programmes. Attempts to improve productivity are more commonly "once off", piecemeal affairs. Chief executives need to take up this matter in the first instance.

5.7 The Role of Government in Productivity Improvement

The Government has a role in productivity improvement, first by ensuring an adequate infrastructure. The weaknesses of the phone services and difficulties encountered in getting goods through the ports in one piece, for instance, are well known. (see C. B. Hurley, 1976). In urging that the Government facilitate productivity improvement by reducing such infrastructural shortcomings, we are not suggesting, however, that other parties—like the unions and the private sector—do not have a role to play.

The second way that Government may influence productivity is through legislation. There would seem to be little doubt that recent legislation, for instance on pollution, prices, and company and personal taxation, has an effect on investment and productivity levels. The debate on these topics is often heated and characterised by special pleading. A great deal of research is required to establish objectively the effects of legislation on productivity.

Third, the Government can give the lead to others. Recently, "reducing inflation" and "creating full employment" have been declared national goals. It needs to be repeatedly emphasised that both

of these ends are contingent on attaining higher productivity. Enlightened statements by the Government could do a great deal to deepen people's understanding of the meaning of productivity and how it could be improved. There is an urgent need to get across the fact that there is a lot more to productivity than "productivity deals", and so long as productivity continues to be aired in terms of hard bargaining for a *quid pro quo*, any national attempt to improve productivity will be hampered. This wider perspective can be fostered without "knocking" genuine productivity bargaining. Also, if the subject were more adequately aired there might be less of a tendency for one party to feel at risk if the other party ventures to raise it.

The barriers listed here, and the others that could presumably be added, certainly inhibit attempts to improve productivity. In our view, however, none of them is insurmountable—which takes us back to the capacity and willingness of management to overcome the obstables. It is a fact of life that under the very same circumstances some firms do markedly better than others because of more adventurous and efficient management. A common human failing is to explain away failure as due to causes and constraints outside of ourselves—or external to the organisation. We take the position here that such scapegoating ignores the extent to which managers can be agents of their own and the firm's destiny, as opposed to being helpless pawns of fate. Consequently, we believe that the single greatest obstacle to productivity improvement is the disposition or attitudes of managers and administrators—whenever they concede defeat in the face of the various obstacles, or seeing the possibilities, do nothing about it.

APPENDIX

DETERMINATION OF RELATIVE PRODUCTIVITY LEVELS FOR GIVEN RATES OF ANNUAL FIXED CAPITAL INVESTMENT: A GUIDE TO MANAGERS

In the past two years, much work has been carried out, first in France (de Bandt, 1975), and then in Britain (Withers *et al*, 1977), to develop a means of making productivity comparisons using net output and fixed capital change data of the sort published in the CSO Annual Census of Production.

The principal way of doing this is to determine, for each industrial sector, values of the following two ratios:

> *Annual added value per employee.* This information, in sufficiently suitable form, is provided in the CSO Census of Production.
>
> *Gross annual additions to fixed capital assets per employee.* Again, increases in fixed capital assets for each sector are given in the Census of Production, as are numbers employed; so this ratio can be derived.

Values of these ratios for each sector may then be plotted as a scatter diagram, and the question raised: does the pattern suggest that a distinctive—say linear—relationship exist between them? De Bandt (1975) found that a very definite relationship did exist—low levels of annual capital formation in a sector were associated with low levels of productivity, and high with high. De Bandt represented this relationship by a straight line, so that it could be expressed as follows:

(added value per employee) = A (annual capital investment) + B

where A and B are numbers found using a standard statistical method. He found that the "fit" was very good. Withers *et al*, in a very extensive

study, found that an even better "fit" was more regularly obtained using the equation

(added value per employee) = a (annual capital investment)^b,

where a and b are again constants, as before determined by regression analyses. Withers *et al* produced figures, year by year, using annual sectoral output data, for six years, for a large number of countries, including UK, USA, Japan, Australia, and many of the European countries, and found that their relationship always held good, with a correlation coefficient always greater than 0.7, and in some cases greater than 0.9—statistically highly significant. How, then, can this relationship be used by firms to make productivity comparisons?

Table 1 shows, in columns 3 and 4, added value per employee, and gross addition to fixed capital per employee, for most of the industrial sectors in Ireland, averaged over a ten-year period from 1964 to 1973 inclusive. The annual figures were adjusted, before averaging, to 1973 montetary values using the Consumer Price Index.[1] These values—there are 44 sets—were plotted on a graph, and the "line of best fit" obtained and drawn.[2] (see Figure 1). The equation for the line of best fit is:

productivity = 215 (annual capital investment) $^{.4194}$

How can we interpret this? The "line of best fit" shown on the graph represents what Withers *et al* referred to as the "national norm" for productivity. In other words, for any given level of average annual capital investment, the expected level of productivity, in terms of added value per employee, can be determined by reference to the graph. Thus, for instance, the average annual capital investment by the Bacon processing sector (No. 4) is £332/employee/year. The corresponding expected level of productivity is, by reference to Figure, 1, (or Table 2—see below) £2,455/employee/year. The actual level is £2,434 (Table 1), which in this case is almost the same as the expected level. The actual productivity level for sector 35—Chemicals and Drugs—on

[1]That this may be a relatively crude way of doing this is accepted, but for the purposes of this analysis it is perfectly acceptable. The values were only adjusted as a means of giving them equal weighting in the average values obtained.

[2]The "fit" was good: $r^2 = .807$ and Student's $t = 8.896$. The linear equation is productivity = 0.419397 (Cap. invest.) + 2.33314.

the other hand, is £5,414/employee/year, as against an expected value of £4,070 for that level of annual investment; the Chemical and Drugs sector has been performing 33% better than the national norm. The percentage differences, relative to the national norm, are shown for each sector in Column 5 of Table 1.

For convenience, the expected values of productivity have been tabulated for annual investment values ranging between £0 and £1,590/employee/year (Table 2). Example: expected productivity for annual investment of, say, £860/employee/year, is £3,663.

So, how can this be used to make productivity comparisons? It can be used to make a comparison of an organisation's performance with the "national norm", or with the relevant industrial sector, or—if the figures can be obtained—with a similar company. Here, step by step, is how to do it:

(1) Find, from the records, the total average number of employees in each of the years 1964 to 1973, inclusive.

(2) Find, also, values of added value (output, adjusted for stock changes, less cost of bought-in materials/services); and total (include plant, buildings and land) additions to fixed assets for the same period. Divide each of these by the number of employees to obtain, for each year, added value/employee, and additional capital investment/employee.

(3) To convert these to 1973 monetary values, multiply each value by the relevant factor given in Table 3. For instance, if added value/employee for 1970 was £700 then the adjusted figure is 700 × 1.31 = £917. (The factors in Table 3 are simply the inverse of the CPI indices converted to a base year of 1973.)

(4) Now calculate average values of added value/employee and additional capital investment/employee, by totalling and dividing by 10 (or whatever number of years you are using).

Let us suppose that the firm is operating in the chocolate confectionery sector (sector No. 11). Let us suppose that the results of the preceding steps show that our average added value per employee was £2.735, for average annual additions to fixed capital assets of £630.

(5) First of all, we can compare performance with the national "average" for that level of investment. We use Table 2 to do this: for annual capital increases of £630, we would expect the added value per employee to have been £3,215. Thus, we would appear to be

$$\frac{3{,}215 - 2{,}735}{3{,}215} \times 100\%,$$

or 14.9% below the national norm.

(6) We can now examine performance relative to the relevant sector. Looking at Table 1, the performance of Sector No. 11 was 22.0% below the national norm. Therefore, the ratio of the performance against the sector (both relative to the national norm) is

$$\frac{100 - 14.9}{100 - 22.0} \times 100\%$$
$$= 109.1\%$$

That is, although the performance compared with national performance is about −15%, compared with the sector it is about +9%, which is quite satisfactory.

Suppose that this has been tried out and performance seems to be acceptable, when compared with the relevant sector in this country. If the firm is in competition with other countries, then one may wish to go one stage further and find out how the sector compared with equivalent sectors elsewhere. The work, mentioned previously, by Withers *et al* will help managers to do this, by providing data similar (though not identical) to that provided in this article, for many countries.

As with all other productivity measures, considerable caution is necessary in the interpretation of results. Are there some very obvious reasons why our annual fixed capital increases are higher than the average for our sector? Are there obvious reasons (e.g., the type of product, or the product range) why we might expect to be better than the sector average?

If either productivity, or the rate of investment, or—worst of all—both, are lower than those for your sector, then managers should be prepared to ask some hard questions:

- Which are the areas which may be contributing to low productivity levels?
- Are there particular products which may be responsible for low added value figures?
- Are management systems—and management itself—contributing to poor performance?
- Is the organisation in danger of being overtaken by more "in-touch" competitors?
- Does the organisation have sufficient contact with outside bodies to ensure that it is aware of technical advances which may help to raise productivity?

TABLE 1

Gross annual capital investment and added value per employee: and productivity relative to national norm[1]

1 Industry No.	2 Industry Description	3 Gross Annual Capital Investment (£) Average 1964-1973[2]	4 Added Value (£) per Employee (Average 1964-1973)[1]	5 Productivity Relating to National Norm %
1,2,3	Total mining/quarrying/turf	624	3,113	-2.8
4	Bacon factories	332	2,434	- 0.9
5	Meat (other than bacon)	408	3,078	14.9
6	Creamery products	967[3]	3,011[2]	-21.7
7	Canning/preserves	385	2,007	-23.2
8	Grain/animal foodstuffs	499	3,018	3.5
9	Bread/biscuit/flour/confect.	262	2,004	-9.9
10	Sugar	378	3,319	27.9
11	Cocoa/choc/sugar/confect.	342	1,941	- 22.0
12	Misc. foodstuffs	542	2,240	25.8
13	Margarine, cooking fats, etc.	306	4,791	101.8
14,15,16	Alcoholic drink	895	5,319	42.8
17	Aerated/mineral waters	626	3,384	5.5
18	Tobacco	599	4,627	47.0
19	Woollen/worsted (excl. clothing)	364	2,119	- 17.0
20	Linen and cotton	248	1,889	- 13.1
21	Jute/canvas/misc. textiles	682	2,375	- 28.6
22	Hosiery	322	1,928	- 20.6
23	Boot/Shoe (wholesale)	104	1,735	14.9
24.1	Clothing: Men's and boys'	65	1,290	4.0
24.2	Clothing: Shirtmaking	66	1,194	- 4.3
24.3	Clothing: Women's and girls'	96	1,407	- 3.7
24.4	Clothing: Miscellaneous	85	1,223	- 11.9
25	Textile goods and apparel	225	1,731	- 17.1
26	Wood/cork manufacture (excl. furniture)	328	2,120	13.3

[1]Greer (1977), and CSO Census of Industrial Production Data.
[2]Adjusted to 1973 monetary values.
[3]Average: 1964-1972 incl.

TABLE 1—*continued*

Gross annual capital investment and added value per employee: and productivity relative to national norm[1]

1 Industry No.	2 Industry Description	3 Gross Annual Capital Investment (£) Average 1964-1974[2]	4 Added Value (£) per Employee (Average 1964-1973)[1]	5 Productivity Relating to National Norm %
27	Furniture/fixtures	149	1,638	6.7
29	Paper/paper products	358	2,481	2.2
30	Printing/publishing/allied trades	237	2,539	19.0
31	Leather tanning/dressing	265	2,788	23.4
32	Leather manufactures (excl. footwear)	135	1,515	10.1
33	Fertilisers	1,475	4,606	0.3
34	Oils/paints/inks/polishes	419	3,658	35.0
35	Chemicals and drugs	1,106	5,414	33.0
36	Soap/detergents/candles	279	2,978	30.4
37	Glass/Pottery/china/earthenware	526	2,262	24.1
40	Metal trades (excl. m/c and transport)	500	2,368	18.8
41	Machinery (excl. electrical equipment)	373	2,501	3.1
42	Electrical machinery, apparatus and appliances	290	2,447	5.4
43	Ship and boat building	346	2,301	8.0
45	Assy. and repair of road land vehicles	199	2,621	32.2
46	Assy. and repair of vehicles (excl. 45 above)	359	2,127	16.2
47	Misc. manufacturing	586	2,790	10.5
48	Building and construction	125	2,012	23.3
49	Laundry, cleaning and dyeing	150	1,507	14.4

[1]Greer (1977), and CSO Census of Industrial Production Data
[2]Adjusted to 1973 monetary values.
Note: Industries number 38 and 39 are deliberately excluded from this analysis.

TABLE 2

Expected added value/employee for given gross rates of fixed capital investment[1]

£

a 215
b .419 (Added value per employee)=a (annual capital investment)[b]

	0	10	20	30	40	50	60	70	80	90
0	0	566	756	897	1012	1111	1199	1279	1353	1421
100	1486	1546	1684	1658	1711	1761	1809	1856	1901	1944
200	1987	2028	2068	2187	2145	2182	2218	2253	2288	2322
300	2355	2388	2420	2451	2482	2512	2542	2572	2681	2629
400	2657	2685	2712	2739	2765	2792	2817	2843	2868	2893
500	2918	2942	2966	2990	3013	3037	3060	3083	3105	3127
600	3150	3171	3193	3215	3236	3257	3278	3299	3319	3340
700	3360	3380	3400	3420	3439	3459	3478	3497	3516	3535
800	3553	3572	3590	3609	3627	3645	3663	3681	3698	3716
900	3733	3751	3768	3785	3802	3819	3836	3853	3869	3886
1000	3902	3918	3935	3951	3967	3983	3999	4014	4030	4046
1100	4061	4077	4092	4107	4123	4138	4153	4168	4183	4197
1200	4212	4227	4241	4256	4270	4285	4299	4314	4328	4342
1300	4356	4370	4384	4398	4412	4425	4439	4453	4466	4480
1400	4493	4507	4520	4534	4547	4568	4573	4586	4599	4612
1500	4625	4638	4651	4664	4677	4689	4702	4715	4727	4740

[1]Greer (1977)

TABLE 3

Inverse of consumer price index, 1964-1973, inclusive[1]

(1973 base year)

Year	CPI (Inverse)
1973	1.00
1972	1.10
1971	1.20
1970	1.31
1969	1.41
1968	1.49
1967	1.56
1966	1.61
1965	1.67
1964	1.79

[1]Converted from CPI data included in *Irish Statistical Bulletin* for the period.

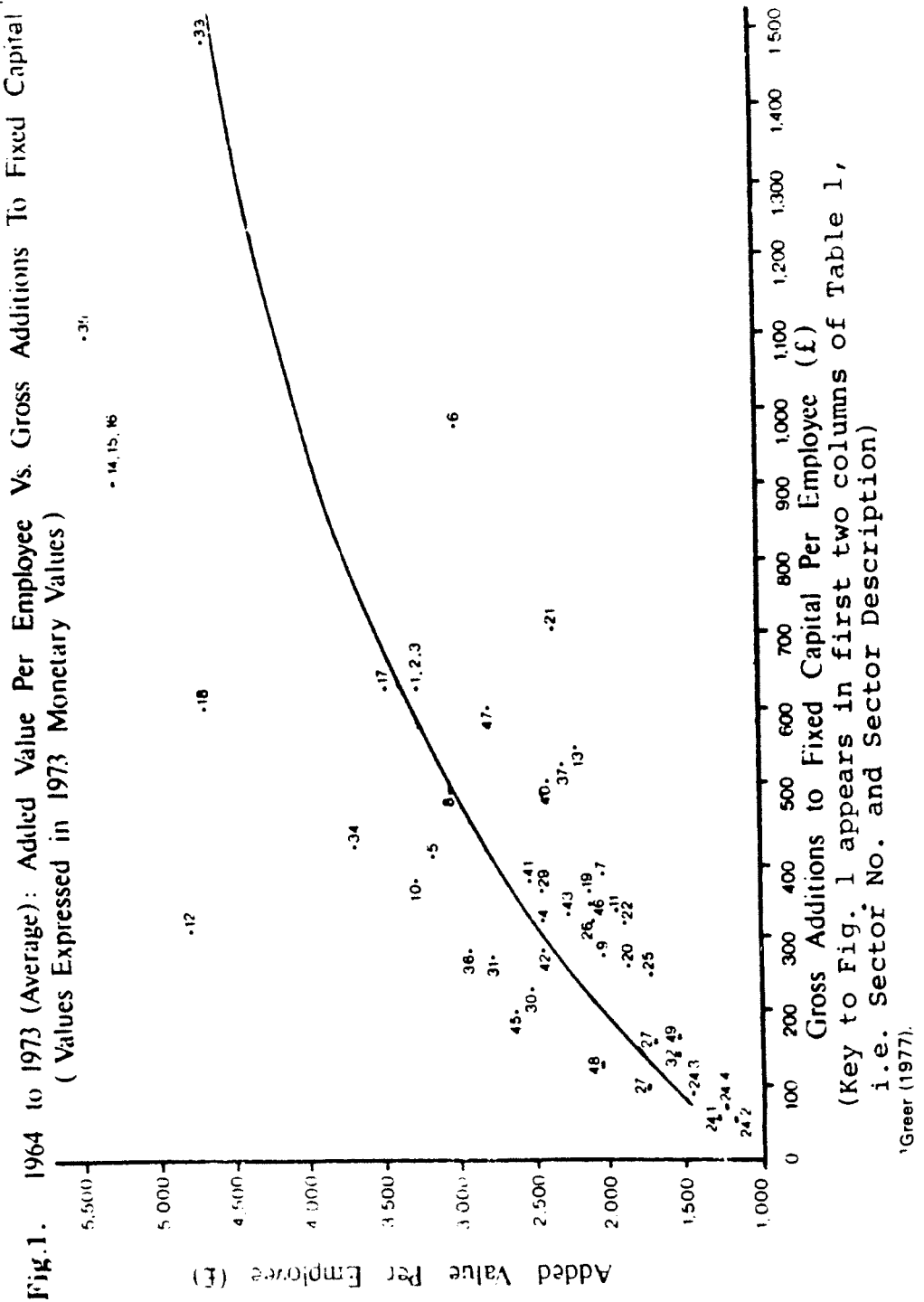

Fig.1. 1964 to 1973 (Average): Added Value Per Employee Vs. Gross Additions To Fixed Capital[1] (Values Expressed in 1973 Monetary Values)

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