

OPERATIONS MANAGEMENT IN A CHANGING SOUTH AFRICA*



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OPSOMMING

Die ontwikkeling van en toepasbaarheid vir vervaardigings- en nie-vervaardigingsondernemings van bedryfsbestuurstechnieke sedert die industriële revolusie word bespreek. Die interafhanklikheid van die kwantitatiewe benadering van wetenskaplike bestuur en die menslike verhoudingsbenadering van die gedragswetenskappe word geskets. Die verandering wat tans in die Suid-Afrikaanse ekonomie plaasvind, demografiese verspreiding van die land se mense en geprojekteerde groei-patrone van die bevolking en mannekrag word teen hierdie agtergrond beskou, ten einde vas te stel watter veranderings en aanpassings aan die onderrig van bedryfsbestuur aangebring moet word. Enkele gedagtes word geopper oor hoe die skrywer die taak van die nuutgestigte Claude Harris Leonleerstoel in Bedryfsbestuur sien.

The term operations has achieved diverse meanings in specific areas. In medicine, it is used to refer to surgical procedures. It is also used to refer to military actions or missions. In business, it has come to have several meanings, operating a machine, operating a plant, conducting an operation or project, performing the required operations to complete a product. All of these meanings have one thing in common. They all involve some sort of transaction, change or conversion.

In manufacturing firms, operations comprise the production activities and by analogy, in non-manufacturing firms the term refers to such diverse activities as getting flights into and out of airports, processing security transactions in financial firms or changing six year old illiterates into scholars, doctors and managers in educational institutions. As working definitions then we can say that:

- (i) *The Operations Function* of all enterprises is concerned with the accomplishment of the end output created for customers or users of that output, be it a physical product or a service, and
- (ii) *Operations Management* is the planning, organising, directing and controlling of the operations function.

This comprehensive meaning of operations and operations management is of fairly recent origin, although the concept goes back to the industrial revolution of the late 18th century when modern management techniques began to be developed in a systematic fashion. In order to put the various operations management techniques into perspective and to appreciate the adjustments which are required to cope

with the changes presently taking place in South Africa, it is necessary to have a look at the historical development since that time.

It is not quite certain whether the growth of the factory system from the guild system which preceded it was due to the invention of various types of power-driven machinery, or to other causes and gave rise to these inventions. Schneider (1) lists amongst others, growing markets for goods, internal decay in the guilds, destruction of feudalism, large amounts of capital for investment from the new worlds, favourable political climates and even the coinciding emergence of protestantism with its emphasis on a rational way of life. Whatever the causes may have been, this atmosphere of rationalism led to the scientific management movement, a movement which like the natural sciences was based on the premise that one really only knows something about a matter when one can measure it and express it in terms of a number and a unit. In other words when one can quantify it.

Adam Smith (2) in his "Wealth of Nations" published in 1776, is recognised as the first to have written on the subject of scientific management. He discussed the advantages deriving from the division of work — skill development, time saving and creation of conditions conducive to the invention of machines. Charles Babbage (3) showed that such division of work in the manufacture of pins not only resulted in the advantages just mentioned but also permitted the division to be made into activities requiring more, and less highly skilled workers. Thus a group of men all making the complete pin — and therefore needing to be qualified to do the most specialised operation, tinning — could be replaced by fewer men of that level of skill and the rest less highly qualified, with a

* This is an adaptation of the Inaugural Lecture delivered by Professor Prekel in September 1977.

resulting reduction in wages and cost of production. Babbage employed a crude form of time and method study to quantify his observations.

While these ideas spread and accelerated in the years after Smith and Babbage, particularly in the latter half of the 19th century, it was left to Frederick W Taylor (4) to develop a systematic concept of scientific management, based on the following four "duties of management":

1. the replacement of rule of thumb methods by quantitative measurement of each man's work;
2. the selection and training of the worker for each task so measured, rather than letting him select his own task and train himself;
3. the development of hearty cooperation between management and workers based on these scientific principles;
4. the equal division of work, again according to these principles, each according to his qualifications, between managers and workers.

Taylor, not only a writer and observer like Smith and Babbage, was also a doer and introduced the tools necessary to implement his ideas — modern techniques of stopwatch time study, job planning aids, management by exception techniques on the shop floor, costing and control systems.

Other contributors to the early scientific management movement were:

	<i>Best known for:</i>
Frank and Lillian Gilbreth	Motion study
Henry L Gantt	Scheduling charts
Harvington Emerson	Principle of efficiency

All of them and many others were really engaged in operations management, but were of necessity in manufacturing concerns because quantitative measurements were easiest, and often only possible, on the production of physical goods. This is why the name production management rather than operations management came to be used.

A notable exception was Morris L Cooke who published two books (5, 6) in 1910 and 1918 respectively describing the application of the techniques and principles of scientific management to University Administration and Municipal Government respectively.

The great difficulty that beset the investigators after Taylor was the complexity of most of the problems they faced, the large number of interrelated variables and the lack of mathematical techniques to handle them. Even if they had existed, the time required to solve the equations would have been measured in man-lifetimes. The modern high speed computer was not to become available to companies until the 1950's.

It is a sad, and at the same time, paradoxically, fortunate fact, that man's preoccupation with war and the means of destruction has led to the development of most of the tools and techniques needed to make

his life easier and more comfortable. Operations management is no exception. The rise and growth of the factory system itself was aided in no small measure by the growing need of governments for uniforms, gun powder and other military equipment. The second world war likewise provided the climate for spending large sums of money to develop the mathematical and computational techniques to solve the post-Taylor dilemma. Statistical quality control and work sampling techniques, developed by Shewhart (1931) and Tippett (1934) were refined and extended, linear programming was introduced and, most important, the computer was developed. Waiting line theory, simulation, inventory control models, network analysis all became possible and were introduced into the business world after the war. This whole body of scientific management tools with emphasis on statistics and mathematics, known as operations research or OR, now forms an integral part of operations management.

The great flaw in Taylorism and the Scientific Management Model of his time was the underlying assumption that man is a rational being. For the system to work, both managers and workers had to put in their — "equal share of work" — based on rational, scientific calculation of how this would maximise their profits and earnings respectively.

Taylorism in short considered human beings as rather inefficient, general purpose mechanisms, possessed however of rational capacity to recognise their own interests. This recognition would turn them into manifesting qualities of thrift, industry and zealotry and would thereby turn them into special purpose mechanisms. Work and working environment only needed to be shaped to take account of these human characteristics.

Managers and workers alike however refused to be mere mechanisms, general purpose or otherwise, and Taylorism and organisational design based upon it became beset with all manner of problems. A large number of charlatans who got onto the bandwagon and sold their own ill conceived versions of the Taylor system made matters worse.

All sorts of experiments were tried to solve these problems, always with the point of departure that the work and working conditions were not properly attuned to the workers' interests. The solution or what was thought to be the solution was discovered by a group of sociologists during the late 1920's in what have come to be known as the famous Hawthorne experiments. These experiments which were conducted at the Hawthorne, Illinois plant of the Western Electric Company set out to find the elusive correlation between productivity and various factors such as longer or shorter rest periods, different methods of pay, lighting conditions, and longer or shorter working days. Surprisingly productivity kept going up until it reached a plateau well above the average no matter what was done to the factors and

Roethlisberger and Dickson, the researchers were forced to conclude that (7):

“the experiment they had planned to conduct was quite different from the experiment they had actually performed. They had not studied the relationship between output and fatigue, monotony, etc. so much as they had performed a most interesting psychological and sociological experiment. In the process of setting the conditions for the test, they had altered completely the social situation of the operators and their customary attitudes and interpersonal relations”.

High morale, due to a feeling of importance, belonging to a special group and doing something of interest and importance was found to be the cause of the improved output. The human relations school, which rejects the view that people are essentially rational beings was born. On the contrary, according to the school, they are moved instead primarily by sentiments and emotions, desires to gain acceptance and affection by fellow human beings, irritations, frustrations and likes and dislikes. These are the bases of their beliefs about their environment — rational or not — and they react to it in terms of these beliefs. The pendulum swung away from scientific management to group behaviour as the underlying, controlling factor. Industry became looked upon as a small society or culture within the larger one of its environment but separated from it. Within the constraints set by the environment, formal organisation must meet the aims of the informal groups that make it up and vice versa or mechanisms will come into operation to restore the equilibrium. If managers were taught to understand informal groups, and its workers were to participate in decision-making to reassure them about possible threats to their values and sentiments, harmony would be achieved.

Of course, the human relations school itself was well aware that their model by no means always worked the way it was supposed to, but, as with the scientific management problems, the fault was sought not in the model itself but this time in the social system. Failure to provide the right social environment, lack of communication, introduction into the plant of incompatible attitudes formed outside and the like were thought to be the culprits. As Schneider puts it:

“It is noteworthy that the human relations school rarely considered that conflict or deviation in the plant might arise from a genuine clash of interests, or from a contest for power; such a view would not have accorded with the human relations view of human nature or the nature of social organisation”.

As with everything else, the answer probably lies somewhere in the middle and is a mixture of two or more likely more of the bewildering number of models which have been appearing recently. Perhaps the pendulum will come to rest at some variant of March and Simon’s decision-making model (8). This combines aspects of modern behavioural science with rational decision-making. Decision-making theory

rejects Taylorism’s conception of man as a passive instrument as well as the human relations concept of him as being moved largely by irrational forces. Man is seen rather as possessing the power of choice, with a memory of the goals to be striven for, the ways which have been successful in the past and the possible alternatives to action.

The important aspect for this discussion is however that both quantitative methods and environmental and cultural factors have their important places in operations management and must be taken into account.

If operations management applies to all kinds of businesses, and if it is a function of so many parameters, then it will not come as a surprise that its application also depends upon the state of economic development of a country. The level and sophistication of quantitative techniques which can be applied for example will clearly be different in a developing country and a highly industrialised one.

The rate at which this development takes place will determine to what extent all aspects of operations management from teaching to applying it must be adapted. In this connection it is useful to look at Pelsler’s classification of industrial activities (9). (Figure 1).

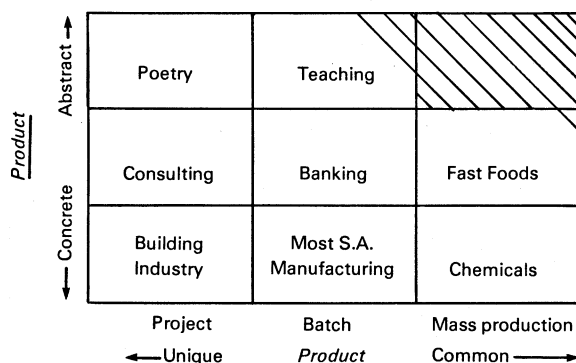


Figure 1: Classification of Economic Activity by Product characteristic

The classification is fairly self-explanatory. It is based on properties of the product which is produced, from unique or “one-off” on the left to common or mass-produced on the right and from concrete to abstract from bottom to top. Although divided into nine areas for convenience the variations must be seen as continuous. The examples given in the blocks are merely a few typical ones.

Operations management techniques are applicable to the bottom two rows, i.e. all manufacturing types or producers of physical products and those service firms which have at least some quantifiable output. (Nobody has as yet come up with a satisfactory method of measuring the quality or quantity of teaching). Two examples of the possibility to apply operations management techniques in service firms may suffice.

1. The Graduate School of Business of the University of Chicago has described a model (10) to manage

daily cash balances. Viewing cash as another inventory item the model combines an inventory control model with a modified version of quality control charts to calculate upper and lower limits which if cash holdings reach them trigger off orders to invest in or sell securities to return the cash balance to a desired level. Applied to historical data, the model did better, cost wise, than the financial manager had.

2. Some Japanese Restaurants employ, very successfully, time study techniques on expected meal times to arrive at improved utilisation of their facilities. Parties are made up during pre-meal cocktails to fully occupy tables and courses are served with regard to the established time standards. The further introduction of queuing theory and techniques seems obvious.

Figure 2 shows the general trend of industries (from left to right) and people within them (away from manufacturing and into services) as economic development proceeds. The USA became the first service economy in the late 1950's when white collar (tertiary sector) workers outnumbered blue collar (primary and secondary sectors). Dozens of countries have followed since.

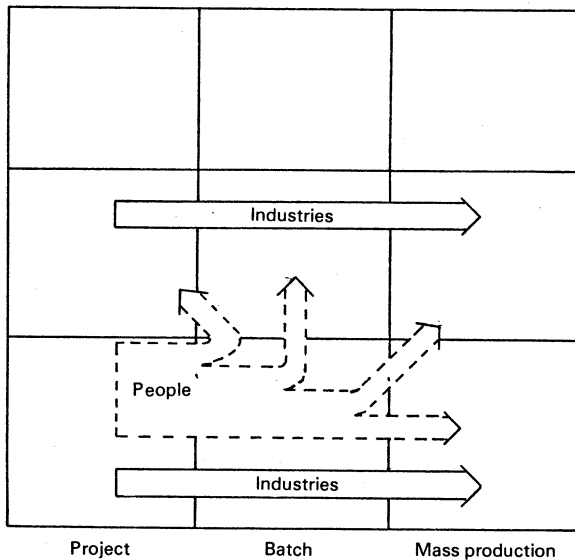


Figure 2: Shifts due to Economic Development

The changes taking place in South Africa which are relevant to this discussion can be seen from the following figures. The data are derived in the main from publications of Benbo, the Economic Research Bureau of the Economic Development Corporation. The projections must be seen as representing what will happen if present conditions remain the same. This of course is unlikely to be so, given the economic and political situation as it is. It is not, however, within the scope of this discussion to go into these matters. The trends, while therefore somewhat generalised and simplified, nevertheless give a reasonable indication of the changes to come.

Figure 3 shows where at the moment South African

economic activities fall on Pelsers' classification. The fact that there are two distinct economies — black homelands, barely out of the subsistence level, and white areas which include urban blacks in the industrial stage can be shown with reference to figure 4 which gives data on the manpower distribution. Looking at Whites alone, 68,5% of the economically active population are in the service sectors. This is well above the 50% needed to be classed a service economy. Adding the Blacks in White areas, however, lowers the figure to 47,5% and puts us in the industrial stage.

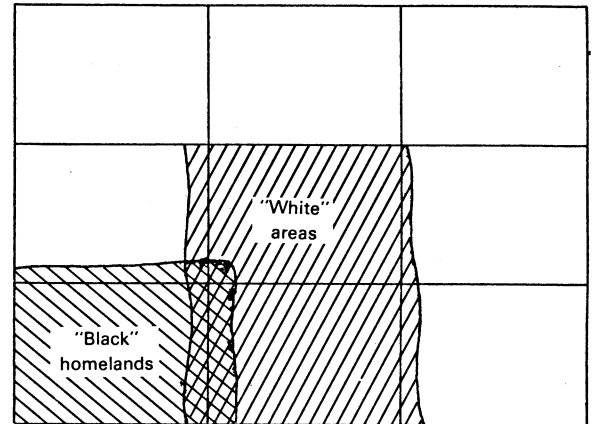


Figure 3: Development stage of the South African economy

All numbers in thousands		Primary sector	Secondary sector	Tertiary sector	Total
Whites	No.	130	420	1 200	1 750
	%	7.5	24.0	68.5	100.0
Blacks in White areas	No.	1 420	660	1 220	3 300
	%	43.0	20.0	37.0	100.0
Total in White areas	No.	1 550	1 080	2 420	5 050
	%	31.0	21.5	47.5	100.0
Blacks in Homelands	No.	1 900	300	500	2 700
	%	70.0	11.0	19.0	100.0

Figure 4: Manpower Distribution in South Africa (1977)

The extremely high percentage of Whites in the tertiary sector is partly due to our uncommonly high proportion of people employed in government departments, provincial administrations and local governments (about 40%). The distribution of manpower in the homelands with 70% in the primary sector, mainly agriculture, makes them pre-industrial.

The next four figures show projections to the year 2000. Figure 5 shows the population growth (Blacks and Whites only) with Blacks outstripping Whites and requiring something like 5 million new jobs to be created of which about 3 million or 60% will have to be created in the White areas. The projections are based on the present growth rates of 2,8% per annum and 2% per annum for Blacks and Whites respectively. The assumption that the 2,8% per annum rate of Black population growth will continue to the year 2000 is open to doubt since the rising affluence accompanying economic development generally leads to lower birth

rates. Provided the White influence can be maintained, Black economic development will continue to accelerate in South Africa in contrast to the situation in many of Africa's independent states.

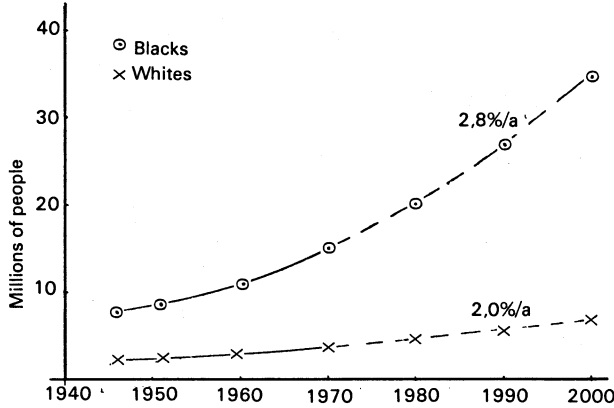


Figure 5: Projected Population Growth

Figure 6 shows that the gap between Black workers in White areas and Homelands is more likely to widen than narrow in absolute terms. Percentages will remain about the same with Homeland workers at about 80% of workers in White areas.

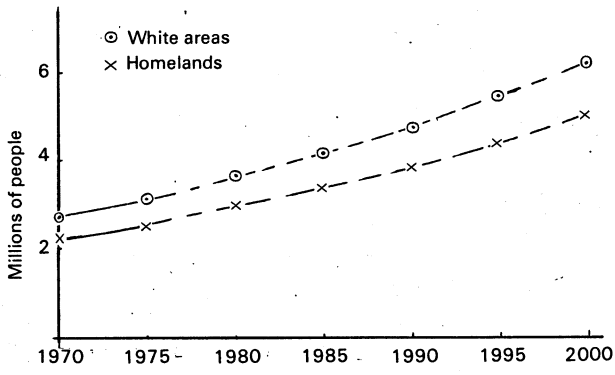


Figure 6: Projection of Black Workers in Homelands and White areas.

Figure 7 when adjusted for population growth shows that for a considerable time to come Blacks will remain dependent on work in the primary sector (mainly agriculture), but that they will increasingly move into manufacturing.

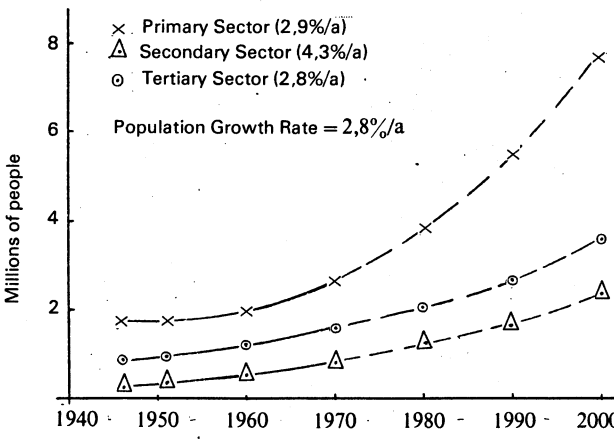


Figure 7: Projection of Black Worker Distribution by Economic Sector

Figure 8 shows Whites continuing to move out of the primary sector as well as out of the secondary sector (since 1.8% - 2.0% (population growth rate) = -0.2%) into the tertiary sector.

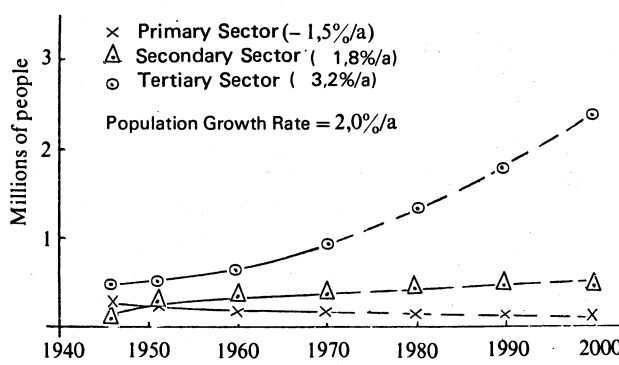


Figure 8: Projection of White Worker Distribution by Economic Sector

These trends are summarised in figure 9.

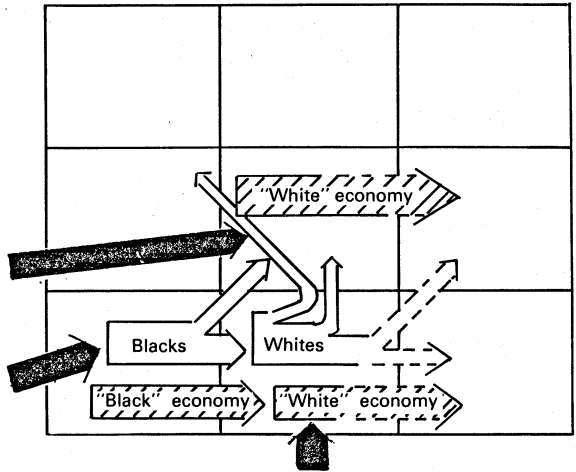


Figure 9: Shifts in the South African Economy

The "White" economy is definitely moving towards the right and up (whether it will ever get to the highly industrialised, mass production stage will depend on political developments. Acceptance by the rest of Africa will be necessary to provide the large markets which mass production requires). The "Black" economy is likewise starting to move, albeit much more slowly, towards more industrialisation and Black workers will increasingly move in, in order to

- (a) fill the voids left by Whites moving out of the secondary sector and
- (b) fill those already existing due to the continuing shortage of Whites. The alternative is increasing Black unemployment and unrest.

The need for training of Blacks on a large scale, particularly in the operations management (secondary sector) field is obvious. So is the desirability of more use of quantitative techniques in service industries as indicated by the growing move towards that sector.

The techniques and expertise to tackle the second

aspect exist. What is needed is a shift in emphasis in teaching operations management to service applications even though text books are still lacking. Most of them are now entitled Operations Management but the contents is still pure Production Management. This can be overcome, but research is needed to develop further applications in service firms and indeed to devise methods of quantifying more of the activities in these areas.

Developing a course or courses in operations management for Blacks is another kettle of fish entirely. The basic problem (or perhaps better, symptom) of the Black man's difficulty in learning quantitative subject matter is well-known and universal. This general problem still exists without satisfactory solution, even in the United States. The author does not agree with those who tend to ascribe it to any basic inferiority in intelligence, but believes that background, cultural heritage and inadequate schooling are more likely to be the causes, coupled with a rather interesting form of hero worship/identification effect (much in evidence in the USA). Politicians, lawyers, and preachers are "visible", they are seen to be "making it", to have opportunities. Black "production" managers are neither visible nor do they have much opportunity as yet in South Africa. This last aspect is however changing rapidly, particularly in the Homelands and the change will accelerate if the fact that the Wiehahn Commission has been appointed to review all labour legislation is anything to go by. A third and serious problem is the fact that Blacks are being subjected to a leap from a basically subsistence economy straight into an industrial one, without the benefit of having gone through the craftsman stage as in the pre-industrial revolution guild system of Europe. The basic appreciation of technology and timeliness is therefore lacking.

The problem of inadequate education is obvious from the following figures:

1. Black student to teacher ratios have deteriorated from about 43:1 in 1940 to about 60:1 today and will probably go to 75:1 in 2000. This refers to all schooling. Secondary and other teaching, e.g. trade schools, run at about half of these ratios. Whites by comparison are about constant at 20:1 (total) and about 15:1 (secondary and others).
2. In 1976 there were about 2,9 million enrolments of Black children in primary schools. Of these, past figures suggest, only about 13% will reach secondary school level and less than 2% will make Matric.
3. There were about 3 200 in trade schools (300 in White areas) and 470 at colleges for Higher

Technical Education. The majority of them in medical technician or related subjects.

4. 5 200 students were at Black Universities (18% in Natural Sciences and Mathematics and 18% in Commerce and Administration — none in Engineering). About 5 500 were at White Universities (about 95% of them at Unisa). The percentages of Natural Science and Mathematics, and Commerce and Administration students were considerably less at some 6% and 10% respectively.

To the best knowledge there is one qualified Black engineer in South Africa. A tremendous amount of money and effort is being spent by both the government and the private sector to improve the situation and reverse some of the trends. But the need for much more is evident.

Finally, a recent study, published in March 1977, by the Rockefeller Foundation (11) on management training in developing countries, throws considerable light on the cultural background problem and in particular the transferability of Western style management techniques. The major finding was the confirmation (as indeed also demonstrated in the first part of this paper) that management ("operations" or otherwise) must be seen in the social context in which it is practised and that more and more evidence is emerging questioning the transferability, indeed the advisability of trying to transfer western models unchanged.

Interestingly enough there is "qualified" consensus that quantitative operations management techniques may be transferable provided that the "surrounding administrative culture" is what is called "congruent". However, the more the subject matter is culture bound (hierarchy, norms, interpersonal relations, decision-making under uncertainty, etc.), the more problems can be expected. One must indeed agree with Benbo (12) when it raises the question whether the time has not come to adjust our teaching more to the value systems of the Black man.

These then are some of the issues to be faced in the immediate future by the teachers and the users of operations management techniques alike. A considerable amount of research will be required to find answers to the problem. A valuable contribution towards this end has been made by the Claude Harris Leon Foundation through the donation of a chair in operations management to the School of Business Leadership of Unisa. The author is honoured to be the first to have been appointed to this chair and to have the opportunity to apply himself to some of these vital issues.

BIBLIOGRAPHY

- ¹ Schneider, E V: *Industrial Sociology*, McGraw-Hill, 1969
- ² Smith, A: *The Wealth of Nations*, Penguin Books Reprint, 1977
- ³ Babbage, C: *On the Economy of Machines and Manufacturers*, Charles Knight London, 1832
- ⁴ Taylor, F W: *The Principles of Scientific Management*, reprinted in *Scientific Management*, New York: Harper and Bros. 1947
- ⁵ Cooke, M L: *Academic and Industrial Efficiency*, New York: Carnegie Foundation, 1910
- ⁶ Cooke, M L: *Our Cities Awake*, Garden City: Doubleday, Page and Co., 1918
- ⁷ Roethlisberger, F J and Dickson, W J: *Management and the Worker*, Cambridge: Harvard University Press, 1939
- ⁸ March, J G and Simon, H A: *Organizations*, John Wiley and Sons, New York, 1958
- ⁹ Pelsler, G: Private Communication
- ¹⁰ Miller, M H and Orr, D: *Mathematical Models for Financial Management*, Selected Paper no 23, Graduate School of Business, University of Chicago, 1966
- ¹¹ Education and Training for Public Sector Management in Developing Countries, Editors: Stifel, L D, Coleman, J S and Black, J E: Special report: Rockefeller Foundation, 1977
- ¹² Black Development in South Africa, Benbo Publication, Published by Perskor, 1976