THE MANAGEMENT OF SCIENCE EDUCATION IN MALTA

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ABSTRACT

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The structure and organization of the Maltese System of Education have confined the management of education in general and of science education in particular to the top level of the hierarchy.

An investigation into the managerial processes adopted has been carried out with the purpose of defining the effectivity and efficiency of the measures taken. Within the context of the developments of education in Malta and of the trends in science education world-wide, the management of science education in Malta has been found lacking in clear objectives and skills. This resulted in lack of continuity, the continual use of adaptive measures and a plethora of time-consuming procedures.

In view of the availability of human resources and of the need for the endogenous development of science education, a participative style of management is being proposed.

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I dedicate this work to my wife, Jane, and our three children, Daniel, Judith and Matthew.

CONTENTS

INTRODUCTION AND RATIONALE

The public sector and the private sector are the two components of the system of education in Malta.

While the State controls and finances the public sector, private sources, the payment of school fees, voluntary contributions by parents and Government financial aid subsidize the private sector.

Government, through laws and bilateral agreements, exercises a significant amount of control over private schools which are run by religious orders under the aegis of the Catholic Church and by individual licencees or body corporates.

Government schools and a number of Private schools provide education at primary, secondary and sixth-form level. Tertiary education is provided by the University of Malta which enjoys a relatively high degree of autonomy.

The main concern of this dissertation is the management of science education in the State secondary schools of Malta.

For the purpose of the study the term 'Secondary Schools' refers to the level of education available to Maltese children after having

completed a full six-year course of studies at the primary stage and before embarking on a post-secondary level course. The age-range of the school population involved is the 11+ to 16 years' range. Although not considered separately, due regard has been given to the science courses resulting from the school differentiation prevailing in the local system of education.

A further qualification that needs to be made is that of the term 'Science Education'. Within the context of this discussion the term is applied to all those activities - learning and teaching experiences, curriculum development and innovations, administrative roles and processes, policy formulation and decision-making - that influence the distribution of knowledge and meaning of the course content in the four subject compartments of General/Integrated Science, Biology, Chemistry and Physics.

Science education is, therefore, being considered as an attempt to channel the need of a group of students into the acquisition of a culture - a system of values. That is, science education is taken to mean much more than teaching the basic sciences for the sole purpose of producing more and better scientists for the future. It really means initiating children into the spirit of inquiry - a search for knowledge and understanding, **and** into a competence in the solution of problems - a link with social responsibility. These two characteristics of science education can be accomplished by a collective effort which makes the activity organizational in nature

and dynamic in character. Management is the means by which co-ordination for the achievement of the desired goals can be realised.

However, management studies have developed separately from education studies. Recent and not-so-recent developments have evinced the attempts made to turn the 'Management of education' into a discipline in its own right - given, however, the fact that educationists still apply to education the principles that have been originally employed in industry. This tendency should not be taken to imply that managers in education are prone to be concerned over the output of **material units**. It is, in fact, their deep concern over the production of **social units** that seems to be the cause of the apparent delay in establishing management principles which apply exclusively to education. Consequently, the management of **science** education is further restricted in its choice of management processes.

An investigation has, therefore, been carried out in order to collate the measures taken by science education managers in Malta during the last thirty years. Of particular interest is the effectivity of the management processes adopted within the socio-economic and educational context of our 'insular but not insulated' island (Vassallo, 1970).

It needs to be stated at the outset that the development of science education in Malta can hardly be distinguished from that of general

secondary education. In such a small educational enterprise as the education system of Malta, one can freely assume that no independent sub-systems are effectively present.

The main points of information have been traced from the *Workings of the Education Department, Malta*, Department Circulars and Personal Notes issued by the Education Office. Moreover, a questionnaire (see Appendix) - followed by an interview - was sent to personnel engaged by the Education Department and still serving in their capacity among the higher echelons. Another questionnaire was sent to the Administrative Secretary of the Malta Union of Teachers - considered locally as the major representative union of the teaching grades and administrative sector of education in Malta. The purpose of this exercise is an effort to provide answers to vital questions such as: Who is involved in policy-making? Who takes decisions? Who is responsible for the implementation of policy? What is the role of teachers, parents and students? And what pressures and constraints do all these factors bring on the management of science education?

In order to support, to confirm or otherwise, and to check on the information obtained from the two sources mentioned above, a body of both published and unpublished select literature was consulted. This included a number of theses deposited in the Melitensia Collection of the University of Malta, the Malta Year Book published by the De La Salle Brothers, journals of education - both local and foreign - and

reports commissioned by the Malta Government such as the Crichton-Miller report, the Lewis report and the Cameron report. Reference was also made to reports issued following the organization of seminars/workshops by the Education Department, the University of Malta, the Malta Union of Teachers, political parties and other constituted bodies. Moreover, I also made use of personal experience and intuition, having spent twenty-five years in service connected with science education at various levels.

Support was further sought in a select body of literature reflecting the expertise of formal groups like UNESCO, the International Institute for Educational Planning (IIEP), Schools Council, UK, the Association for Science Education (ASE), UK, proficient case-study researchers in educational development and a number of authors of education theory and practice and management studies.

An attempt has been made, then, to chronicle the general developments in Science Education since 1958 against a background of some important educational developments and the managerial processes concomitantly used.

Chapter One of the study deals with the education system at work and it includes three sections. It highlights some important events in the history of education in Malta and it identifies the interactions that exist between the stated political and educational aims. It also reviews landmarks in the development of science education in the

light of the changes occurring as a result of the reforms and innovations introduced during the period of time under consideration.

Chapter Two, 'The System: Structure and Organization', attempts to describe the administrative set-up of the educational system. In Malta, a hierarchical system prevails and this chapter explores what adaptations were made as the range of school differentiation widened in conjunction with the general progress recorded and with the increase in the number of secondary school students taking science. A brief survey of the development of the science curriculum, in terms of the content of the courses organized and the learning experiences offered, brings the second chapter to a conclusion.

Chapter Three, with its overall title 'The Management Process', focuses on the task of management. 'Management Theory' is dealt with in the first section. A brief review of the major theories proposed is given and a discussion on the functions of management and leadership styles then follows. Since the ultimate task of managers is decision-making, the leadership role adopted by the manager within the environment in which she or he functions is the most important factor to be considered.

A survey of the management processes adopted is then given in the next chapter. In this connection extensive use is made of the responses to the questionnaire sent to officers still serving in the Education Department and to the Administrative Secretary of the Malta

Union of Teachers. The reactions to the questionnaire itself and to those observed during the interview that followed proved to be an eye-opener with regard to the areas I set out to explore. The answers obtained ranged from complete disregard to full co-operation.

A chapter (Chapter Four) on 'Trends in Science Education' - based on the directions in which improvement has been sought abroad - then follows with the aim of providing a comparative and contrasting background for local strategies.

The final chapter, 'Appraisal and Recommendations', seeks to highlight the main conclusions derived from this study about the measures taken in response to the development of science education in Malta. The three decades under review demonstrate the peculiarity of the local system of education and the managerial approaches adopted. A management strategy is being proposed whereby priority is given to a humanistic approach - an approach which strives for the development of a 'corporate strategy' (Davies, 1975) in which individual and group potential for creative thought are released through the challenge of participation. Since participation results in a greater level of responsibility and commitment to the performance of tasks and the corresponding skills required, importance should be given to the education of managers; or, rather, to their development. A holistic, ongoing approach is, therefore, being proposed.

CHAPTER ONE

GROWTH AND DEVELOPMENT OF EDUCATION IN MALTA

1.1 Some important events in the history of education in Malta

One of the most striking features of the history of education in Malta is the lack of continuity underlying educational policies. This feature could be the result of two major politico-cultural factors. Firstly, Malta has suffered throughout the years the intrusion of a large number of national strains and, secondly, possibly as a consequence of the first, too many ideologically-based strategies have been tried out. In fact it can be noted that the more important and effective events occurred at a time when there was either a change in the colonizing agent or a change in the political party in Government. Consequently, innovations and reforms were often introduced either at random or due to a political commitment and decisions were taken either abruptly or when overdue.

Misguided political decisions did a lot of harm to the progress of Maltese education. They played an important role in determining how and when the educational system responds to the changing parameters of economic and social life, perhaps to a larger extent than is normally expected. A long period of fifty-five years had to elapse

for the problem over the use of an official language to be partially and, perhaps, inadequately resolved. While the clouds gathered before the storm in 1878 over the use of English or Italian as official languages with Maltese playing second fiddle as a spoken but not written language, it was only in 1933 that the Secretary of State for the Colonies decreed that the official languages of the island were to be English and Maltese (Zammit Mangion, 1954). At the other end of the spectrum one finds that, in a period of three scholastic years (1975/76 - 1978/79), the Science Option Special Examination, intended for gifted students, was abolished.

A further complication contributing to the lack of continuity is the time lag between the implementation of a policy and the introduction of the original concept. Because recourse to adaptation has often been considered as the only remedy to a pressing problem, snap decisions or crisis strategies were quite common. Two fairly recent and important events clearly depicting a combination of the factors leading to discontinuity in educational progress were the introduction of secondary education for all in 1970 and the comprehensivisation of secondary and grammar schools into area schools in 1972. Within a period of two years one massive and drastic change, based on the British Education Act of 1944, was introduced towards the end of the term of office of one Administration only to be followed by another equally grand venture - introduced in the United Kingdom over twenty years earlier - launched at the beginning of the term of office of a different administration.

The question of time lag is being considered as of paramount importance for the purpose of this discussion. It would, therefore, be appropriate to quote yet another instance, of contemporary significance, that serves to illustrate lack of continuity. A recommendation to establish the post of Deputy Director of Education was made by Lewis (1967) due to the increasing need for participation by the director 'in consultative and executive committee meetings' (p.16). Notwithstanding the glaring need for such an appointment - and especially in view of the expansion in the structure of the system that was to occur during the following fifteen years - the post remained vacant until April 1988. It seems that Government is now putting into effect recommendations made twenty years earlier.

In a country where formal education is known to have existed since the fifteenth century, the list of important events can become very impressive in terms of achievement. As in the case of illiteracy - reduced from 33% to 15% in a period of ten years (1948 -1958) (Cameron, 1970), teacher training underwent an expansion from a training school in 1881 to regular pre-service training in 1944 and on to the building of two teacher-training colleges in the early fifties. The importance of these two events lies in the fact that they formed the basis of a mass campaign to provide primary education for all. During the same period the Compulsory Attendance Act was passed in 1924 and twenty-two years later primary education

became compulsory up to the age of 14. Full-time primary education was then achieved by 1957.

The establishment of first-level education could not but pave the way to another event of primary importance, that is, the provision of secondary education for all. The eventual establishment of this provision had to be considered against a background of a system whose beginning lies in the founding of a *Collegium Melitense* by the Jesuits in 1592. This *Collegium* was raised to the status of Academy over a hundred years later (1727) and to that of a University in 1768. That is, the nation had a vision of a system with a powerful narrow pinnacle of third-level education and a broad base of primary education. The central part of the pyramid consisted of a vacuum sometimes made partial by a trickle of post-primary adventurous novices. This section of the population must have caused the existence of a few grammar-type secondary schools providing only 7% of the primary school leavers (Cameron, 1970) - by 1955 - with the opportunity to enter third-level education. Obviously, the vacuum had to be filled and the rising demand for secondary education fitted conveniently with the massive school-building programme undertaken at the time. These two factors formed an effective link between primary and secondary education.

Yet another aspect of the socio-political life of the nation which must be considered for the completion of the backdrop to the stage on which this new event had to be cast is the economic situation of

the country in the late fifties. Due to the closing down of the Naval Dockyard and the rundown of the British armed forces - two mainstays in the island's economy - the training of unskilled workers and that of prospective university graduates caused a certain amount of uncertainty as to what should be next on the list of priorities. Would technical education provide the manpower with the requisite skills? Or would it be wiser to strengthen further selective grammar schools in view of the need for qualified trainers? Should not the provision of secondary education for all take first priority since third-level education was only available to a selected few?

1956 saw the establishment of a Department of Technical Education under its own Director and separate from the Department of Education. Secondary Technical schools and Industrial Training Centres were introduced and Sixth Forms were also launched. As quickly as the decision to set up a separate Department of Technical Education was taken so was the decision to reunite it with the main Department of Education three years later. This change of events coincided with the resignation of the government in office at the time. However, during the following three years - under a Colonial Administration - Technical Institutes were opened as was the Polytechnic (also known as the Malta College of Arts, Science and Technology). It has to be emphasized at this stage that these two projects were started in 1961-62 - with the help of UNESCO and British financial aid - that is, at the time when the Colonial Administration was replaced by a new local government. Further assistance to Government from the

Commonwealth Welfare and Development Fund then led to the laying of the foundation stone for a new University building at Tal-Qroqq in 1964 to coincide with the achievement of political independence for Malta. Following this political achievement the emphasis was on post-primary education, chiefly technical education.

The view had been taken, then, that the changing economic needs of the country require the development of the technical side as a prerequisite for the provision of technical and middle management education in order to cater for the future needs of light industry.

Towards the end of the 1960s, the demand for secondary education for all became too big to resist. The main planning concern was for the introduction of second-level education for all 11+ pupils. Not only was the need educational in nature but also political - this became an irresistible move. Elections were due in 1971 and so the urgency increased to the extent that in less than three years, in October 1970, 'Secondary Education for All' was launched. From a total of six government grammar schools and four secondary technical schools, no less than fourteen New Secondary schools for boys and sixteen for girls catering for 11 200 children in Form 1 with a complement of nearly 700 teachers were opened. The massive school-building programme referred to earlier came in handy as a number of primary schools were selected for conversion into secondary schools.

Although education does not create national headlines in electoral periods and is not a preoccupation of most career politicians, the criticism levelled at the Government of the time, on this particular issue and on the issue of unemployment, had a devastating effect on the progress of education. The number of innovations, reforms and counter-reforms that Maltese education had to undergo between 1971 and 1986 under a new government is too vast to list in this brief account of important events. Not a single section of the whole system was left untouched by the multitude of changes. This is not to imply that all changes were made capriciously; it is, however, to stress that the plethora of problems created by incessant change only favours discontinuity. On the other hand, it does imply a lack of consensual planning and, perhaps, even political and ideological strains.

Only those who lived through the introductory period of secondary educational for all would have been able to recognize its face less than two years later. By 1972, the secondary school system was reorganized with some schools closing down and others opening. The curriculum was now based on a two-year comprehensive programme in common subjects and examinations and entry tests were completely abolished. Only three years needed to elapse for the re-introduction of formal annual examinations 'in order to motivate students in their studies' (*Workings of the Education Department*, April 1974 - August 1975). At the same time, students who reached the age of 13+ - or

rather after completing Form III - were given the option to transfer to Trade Schools.

The importance of this event lies in the following facts:

i. it created an opportunity for those students identified by the system as 'unmotivated';

ii. it led to a new grade - in the teaching profession - that of 'instructor'; and

iii. it helped in the development of schemes whereby intakes into secondary schools were being 'diverted' in order 'to correct the size of schools' (*Workings of the Education Department*, April 1974 - August 1975).

It is worth noting at this stage that in 1974 a new Education Act was passed and the school-leaving age was raised to 16.

Reference was made earlier to random reforms. It seems that, because the school-leaving age was raised at this particular point in time, a snowball of adaptive measures had to be taken. For instance, comprehensive education came to an end two years later (1976); recruitment into trade schools started from Form II while courses had to be extended from three to four years (1979); and an Extended Skills Training Scheme for boys was launched (1980) - girls being admitted into the scheme two years later.

Obviously, events of this nature do produce positive and relevant results. Mainly they provided a number of opportunities otherwise not available in a selective system. But, events occurring concomitantly, reversed the issue. Junior Lyceums of a purely selective nature were introduced in 1981 giving rise to what had been abolished ten years earlier.

Following ten years of continuous change in the educational system of this island, one can come across other events that serve to highlight a sense of insecurity in the administrative ability of the top managers. The 1974 Education Act was repealed by the 1988 Education Act proposed by a new government. Both Acts reflect a genuine interest in the provision of equity and wide opportunities for all Maltese citizens. However, they also make education more and more fully vested in the hands of the Minister of Education. In this sense, at least, educational decisions have been political though often clothed in the rhetoric of legitimate reform. Perhaps the course of events described is indicative of a pattern that needs a fundamental change towards the legitimacy of broader managerial participation.

1.2 Political and Educational Aims

The summary of important events given in the previous section was meant to yield some insights into the problems of educational progress in Malta. An attempt has been made to obtain a fuller understanding of the relationship that exists between politics and education. 'One would indeed be surprised to find the educational system and the political system in complete disaccord' (Eliot, 1939 - quoted in Lester Smith, 1965). However strong the desire to divorce education from politics maybe, it cannot be done because education and politics are inextricably interwoven. One cannot expect politicians to renounce their interest in education. What one may appropriately hope for is that, when dealing with education, politicians will conduct their deliberations in an amicable spirit and not as an occasion for party warfare.

Two distinctions need to be made: firstly, that between political aims in terms of the general conduct of government affairs and political aims for education as used by politicians talking about the educational system; secondly, that between political aims contributing to educational goals and aims of education emphasizing special features in terms of knowledge and content of the learning process. Our concern is the relationship between the aims **of** education and those aims **for** education as envisaged by politicians. An attempt is, therefore, being made to stress the dyadic interactions that exist between the goals set for education and the

educational state, interests, abilities, opportunities and problems of the learners. In conjunction with these four factors one needs to include public support for educational goals in general and the educators' (education researchers, education officers, tutors, teachers, administrators) support in particular.

'Because of the notion that schools - or any other public institution - should be responsive to the wishes of the people they serve' (King, 1977), it follows that educational policies should be compromises between various interests rather than solutions based on someone's vision of what a sound basis for educational progress is. Whether politicians are well-equipped to decide on educational issues or not, and whether they have the professional means to define policies or not, is debatable. However, they must take decisions if only for the mere maintenance of the system. What needs to be investigated is the extent to which political aims for education make educational development their major concern.

Education is a public concern because it is an expensive and time-consuming social service. It has increasingly become a matter for public debate. Whether any public deliberations - except in one form or another at parliamentary level - do take place before innovations or reforms are introduced is another question. And this applies also in the case of the Maltese educational system. What can be ascertained within the local scene is that a set of specific aims of education has never been formulated except in a very generic way or

in conjunction with Government Development Plans. The generic way of developing aims usually took the form of 'developing the whole personality' (Education Acts 1974, 1988) - reminiscent of the philosophy of the American pragmatist John Dewey. On the other hand, government goals for education as stated in Development Plans always obviously fitted nicely with the programmed views of the planners.

However, two important points must be made at this stage. Expert advice has often guided planners. This is evident in official reports and publications such as the Crichton-Miller, Lewis, and Cameron reports and the *International Handbook of Education Systems* (Holmes, 1983). Also an attempt has been made by the then Director of Education in 1977 - through Circular No. 26/77 dated 31 March of the same year - to list a set of 'Goals of Education' as a reminder. It may have been meant, at least, to cause a debate about these aims but, unfortunately, it failed to cause even a ripple.

Given the political climate at the time, with a ridge of high pressure of reforms and counter-reforms in secondary and tertiary education (vide Education Act 1974 and Act XXI to amend Education Act 1974), it would not be improper to suggest that educators were alienated from the roots of the problem. Were they overcome by frustration?

Although reference is here made to a situation prevailing in the 1970s, cause for concern is justified because of the blurred path

educational planning seems to have taken since the early stages of the time span under consideration in this review, that is, since the late 1950s. The report on *Education in Malta* by D. Crichton-Miller, commissioned by the Government of Malta in December 1956 and presented in March 1957, contains many favourable and appreciative remarks. However, in the concluding section, a point of relevance and significance is made:

> '....., third, the need for a more convincing effort to show that this great expansion in the educational services has not been done too hurriedly' (para. 83).

Ten years later, L.J. Lewis, in his report *Malta - Educational Planning (Preparatory Mission)*, also remarks that 'what is now needed is a definition of policy and the overhaul and strengthening of the legislative and administrative procedures' (para. 56 p.12).

Early in 1968, John Cameron was selected by UNESCO to come to Malta 'to carry on the work thus begun by the consultant' (that is, L.J. Lewis). Having reviewed the prevailing situation in so far as government's strategies for educational planning were concerned, Cameron introduces his concluding remarks in paragraph 35 of the report in the following manner:

> 'In any country education is a very personal matter and any educational administration to be successful has to combine the implementation of agreed policy with good public relations. For reasons noted [earlier] the tendency in Malta is to lose sight of the former in an unavailing effort to fulfil the latter. The result is that both educational planning and policy implementation suffer, there being too many 'ad hoc' decisions which ignore their later implications and indeed occasionally modify almost to the point of reversal carefully thought out and fully-approved administrative measures.'

Cameron's counterpart, the late Dr. Francis Chetcuti, was succeeded in October 1974, by Mr.J. Zammit Mangion who, up to April 1988, was Education Officer II, Administration and Planning Section, Department of Education, Malta. He presented a paper at a National Workshop *Education in Malta: A Look to the Future* (Unesco, 1988) on the 'Expansion and Growth of Education in Malta since 1946.' He attributes the failure of comprehensive education, as proferred by various interested agents, to 'the lack of proper directions and clear objectives' (p.22) amongst other problems. On the same vein and during the same session of the workshop, Dr.J. Calleja, in his paper 'Thoughts on the Concepts and Practice of the Maltese Educational System', points out that:

> 'The present leading problem for the Maltese educational system is the absence of an organic plan aiming at evaluating the problems of the school at every level, as well as the need to define new strategies at the historical, cultural, economic and national level' (p.27).

All the foregoing excerpts, covering the period 1957 - 1987, indicate that lack of communication and lack of clear objectives are two of the main areas which contribute to unfavourable reactions. While lack of communication may be attributed to the administrative set-up of the educational system (see Chapter Two), lack of clear objectives is the result of the traditional emphasis made on national needs.

The large scale educational programme started in the late fifties had as one of its main goals 'the supply of a training ground at home for future leaders' (Crichton-Miller, 1957), while that taken in hand in

the mid-sixties was geared towards the transformation of an educational system from one based on a 'fortress economy' into one 'catering for the needs of a new industrial society' (Calleja, 1988). Government's new political ideologies for the mid-seventies were concerned with the quickest possible exploitation of abilities and so the principal aim for education was 'to promote a greater awareness of the dignity, status and potential contribution to society of her citizens' (Holmes, 1983). Consequential to this polity was the implementation of radical educational reforms - a combination of innovations and counter-measures confirmed and ratified by the stated aims of education for the mid-eighties of 'establishing a closer relation between education and work', of 'serving more effectively the country's personnel requirements' and of making tertiary education 'fully accessible to all' (Farrugia, 1985a).

Viewed with an economic frame of mind as that of most politicians, it is not difficult to understand that the stated aims fitted the different needs of the country. However, the usefulness and practicability of objectives for achieving national goals must reflect the educational state, interests and abilities of the learners. They need to be achieved within the resources available through allocation and through additional ones. Also, as stated earlier, consideration needs to be taken of the fact that education, besides being a social service, is expensive and time-consuming. Concordance, then, needs to exist between national goals for education and educational aims.

As a result of the non-formulation of the aims of education in Malta, the system is riddled with nebulous terminal targets. From a review of the relevant documents already mentioned (e.g. *Workings of the Education Department*; Holmes, 1983, p. 499), statements to this effect are abundant. 'The teaching of basic literacy and numeracy', 'the provision of employable skills', 'streaming in schools', 'streaming of schools', 'gifted children', 'unmotivated children', 'opportunity classes' and 'compulsory subjects' are some of the more common phrases in the literature of Maltese education. They have contributed to - or, perhaps, they were the cause of - the aura that exists around examination results. In other words, aims in education have been translated into examination passes, which serve as a passport into or between the various strata in the hierarchy of post-primary, secondary and post-secondary schools. The diversification of schools has been interpreted as the creation of inferior and superior schools with teachers opting to move from one school into a better one.

A situation, therefore, prevails whereby goals for education are presented in general terms but their interpretation in the context of the actual situations and particular programmes is not clearly defined. And so the agents involved in the educational process are left with indubitable but useless truths. They have neither been consulted nor have they been given the opportunity to form an opinion based on knowledge. Their co-operation is lost because they may have misunderstood or misinterpreted what needs to be achieved.

If a satisfactory philosophy of education is to be framed, it is necessary to state clearly both the general aim and the particular objectives of education.

1.3 Landmarks in the development of science education

The two previous sections (1.1 and 1.2) of this chapter have been concerned with considerations of a general nature. Events in the history of education in Malta and the general aims incorporated have been traced with the purpose of providing a general background to the subject of this section. As politicians and educators were, in a sense, juggling and coping with planned and unplanned events, the various components of the school curriculum were being affected in the meantime. As a consequence of the growth process, landmarks on the level of subject development were also established.

It is, in fact, the aim of this section to complete the setting of the scene regarding the growth and development of education in Malta with special emphasis on landmarks in the development of science education. Science education is not a neutral stock of skills and knowledge. It is a world-wide activity fast growing in importance.

'A history of science education in the Maltese Islands would not be a long one, perhaps not even as long as the history of compulsory

education' (Lewis, 1964). During the thirty years under review, that is, 1958 -1988, two clearly marked periods of time in terms of landmark formation can be identified; namely, that between 1958 and 1968 and that between 1969 and 1988. The first decade may be considered as the 'pre-Secondary Education for All' period. The next twenty years cover the period when most of the reforms occurring reflected the substantial increase in the secondary school population and differentiation and the adaptive measures that had to be taken as a result of the accelerated rate of growth of science education.

From a total of 74 692 children attending state schools in 1957/58, 2615 were enrolled in the 6 grammar schools available. The secondary school section of the system, then, had to provide for 3.5% of the school population with a measure of science education. The number of students enrolled more than doubled between 1959 and 1968. With the introduction of secondary education for all in October 1970, the secondary school population rose from 9618 in June 1969 to 17 771 at the end of the scholastic year 1970/71, showing an increase of 84% (Central Office of Statistics 1971).

Besides the sudden increase in the number of students, this change brought about a vast range of science options. The diversity of options available at one time and in different types of schools can be considered as a landmark in the development of science education.

Most of the students attending grammar schools in 1958 had a Physics/Biology option. Chemistry became available in all the six grammar schools two years later: 'I undertook the writing of this book as a direct result of my coming to Malta from New Zealand in 1960. Secondary education in Malta had scarcely begun, and Chemistry was not a main subject in most schools' (Edwards, 1962). Following some important changes at the Lyceum in 1965, the curriculum was set in such a way that, after Form I, boys could select any one of three groups of subjects apart from the basic ones, that is from (i) mainly arts, (ii) mainly science, and (iii) general (*Workings of the Education Department*, 1965). When secondary education for all was introduced in 1970, general science was made available to all students in Form I, that is, to 11 700 students. Following this episode and developing in parallel with it was the diversification of schools, mainly Trade Schools, and later the reorganization of secondary education with a comprehensive and common curriculum for the first two years which included general science. Five years later, 1975, the decision had been taken to offer to students the option of taking two science subjects (that is, Physics and Chemistry or Chemistry and Biology) instead of the three subjects. A selective examination for entry into 'special' science classes at Form IV level was held at the end of the next scholastic year for groups of 'gifted' students. These were concentrated in 5 centres, 3 in Malta and 2 in Gozo, and accelerated courses were offered.

The year 1979 could perhaps be chosen as **the** year for the establishment of landmarks. Three important decisions were taken simultaneously:

i. the Science Option Special examination was abolished;

ii. Physics was to be included among the compulsory subjects for entry into the Upper Secondary Schools as from 1982; and, therefore, it became compulsory in secondary schools with immediate effect; and

iii. students entering this form were divided into groups: Group 1 for motivated students having Physics as one of the compulsory subjects with four lessons a week and with Biology and Chemistry among the list of additional subjects from which two could be chosen; and Group 2 for the not-so-motivated students with Integrated Science (four lessons a week) as one of the subjects in the common curriculum.

The next measure involving the science option was taken in 1983 following the opening of two selective Junior Lyceums in 1981. Form III students intending to take GCE 'O' level subjects were given the option of adding a third subject of their choice to their curriculum. This entailed curtailing some of the time devoted to certain other subjects. Moreover, all students in boys' secondary schools and Junior Lyceums in Malta were re-grouped as Group 1 students (*Workings of the Education Department*, 1983).

Adding on to the pressure on science education was the setting up of a new type of post-Form V secondary school called the Higher Secondary School. On its launching in September 1984, 886 students were enrolled. The number of options offered to the students was great in number and so diverse that Biology, Chemistry and Physics were taught at both GCE 'O' and 'A' level by the same subject teacher. Since the main aim of the school was to cater for students who still needed to obtain one or more examination passes at the GCE 'O' level in order to qualify for entry into the VIth Form, students could opt for up to four subjects at either 'O' or 'A' level or both. Therefore, science courses running concurrently were classified as:

i. revision courses running from October to December to help students re-taking their examination in January;

ii. another revision course starting in January and intended to coach students for their 'O' level examination in June;

iii. a one-year accelerated revision course for students who had either performed very poorly in their 'O' level examination at the previous session or else did not have the opportunity to study the subject - in particular compulsory Physics - at their former school (usually a private school); and

iv. a two-year course leading to the GCE 'A' level examination.

An example of a typical option offered at the Higher Secondary School could read as follows: English 'O' level, Physics 'O' level, Italian 'A' level and Religion 'A' level.

Evidently, then, this extensive diversification led to the need of a greater number of teachers with the ability and expertise to teach science subjects at different levels. One would have expected that a detailed and broad exercise in the deployment of science teachers would have helped in part or in whole towards the solution of the problem.

Perhaps it may be pointed out that another landmark in the development of science education was established with regard to the provision of teachers of science. In the pre-secondary Education for All period, the situation prevailed whereby an urgent need for improving and extending the teaching of science subjects was felt.

> 'It is generally believed in Malta that Science has been neglected through shortage of teachers and inadequate laboratory equipment .....Equally I cannot agree that science can be developed simply by increasing masters and laboratories. It is time-table space that is required; and it is necessary to be realistic (Crichton-Miller, 1957).

Less than six years later when the grammar school population increased to 3755 from 2615 and the number of grammar schools remained at 6 (the Girls' Grammar School, Valletta, Malta was closed down in 1959 and the students were transferred to the new grammar school at Blata-l-Bajda) (Malta Union of Teachers, 1967), two foreign University professors had the following observations to make:

> i. 'The acute shortage of adequately-trained science teachers made the situation [of textbooks available] even more difficult' (Edwards, 1962); and
>
> ii. 'The difficulty in Science Education on the Islands at the moment seems to be the supply of suitably qualified staff (Lewis, 1964).

It seems, however, that the lack of qualified staff for science was not a reflection of the number of teachers employed by the Department of Education.

> 'One thing the primary and secondary schools do not suffer from is a shortage of teachers.'.....
> The Education Department has persisted in churning out from the two teacher-training colleges primary school teachers it does not need and then solving its alleged lack of secondary school teachers by either recruiting untrained ex-Junior College young men and women straight from the streets or by seconding redundant primary school teachers' (Cameron, 1970).

Which is exactly what the Department of Education did prior to the introduction of secondary education for all .

The end of this pre-secondary education for all 'era' was crowned with another landmark worth recording. In September 1969, an Inspector of Science was appointed to work in collaboration with Mr.Cameron and to supervise the expansion of secondary school science brought about at the time. At the same time that the Inspector of Science (a chemistry specialist) was appointed, an ACTS (Aid to Commonwealth Teaching of Science) officer - a biology specialist - was in Malta to advise government on secondary school science education. He was followed by another biology specialist in 1974. Two years later, in May 1976, a second Education Officer (new designation for 'Inspector') - a physics specialist - was appointed. Immediately the ACTS officer left the island, a call for a third Education Officer (Science) was issued, stating that preference would be given to somebody with qualifications in Biology. The appointee resigned a short time later and another call was issued with the

same stated preference. However, another physicist was appointed. In the meantime, the second ACTS officer was followed at intervals by two other officers (a biologist and a physicist respectively). Their main concern was the drafting of science syllabi (for example, Carter, 1971 '*Syllabus for Integrated Science to cover the first three years of secondary Schools*'; and Fitches, 1976 '*Draft Scheme for proposed Integrated Science Syllabus*'), the organization of in-service training for teachers and the establishment of science Field Centres (for example, Ghadira Field Centre later transferred to Villa Psaigon, Dingli).

What is difficult to explain is that the effort to establish a sound basis for science education in 1970 was placed completely out of focus when two important decisions were taken in quick succession in 1978 and 1979 respectively. These were:

i. The abolition of the Faculty of Science at the University of Malta following the creation of a New University and an Old University (Act XXI of 1978 to amend Education Act 1974); and

ii. The inclusion of Physics among the compulsory subjects for entry into Upper Secondary Education as from 1982 (*Workings of the Education Department*, 1979), referred to earlier (p.27).

This turn of events was in itself a landmark in the development of science education - as significant as the subsequent need to recruit no less than thirty-one expatriate teachers to help in the teaching of various subjects, but mainly science, to students enrolled at the

Junior Lyceums inaugurated in 1981 (*Workings of the Education Department*, 1982). Most of the foreign science teachers engaged were of Czech and Polish nationality and their difficulty in adapting to the Maltese system of education and to the use of English as a means of instruction was not by any measure irrelevant. The negative effect on the pupils need hardly be described.

The second period of time identified in the introduction to this section was further characterized by an ongoing event of much importance; that is, the development of the science curriculum. Although this topic will be dealt with in more detail in Chapter Two, it is worth pointing out three major outcomes:

i. the increase in the production of Science TV programmes and sound broadcasts started in 1968 with the aim of providing 'a general background and an introduction to later, more specialised study' (*Science One - Notes for the Teacher, M.U.P., 1971*) and bearing in mind 'the lack of adequate laboratory facilities in most schools' (*ibid.*). *Science One* for Forms I was followed in 1972 by *Id-dinja Taghna* for Forms II, by *Discovery* for Forms IV and V - an integrated approach - in 1974, and, a year later, by *Xjenza Klabb* for average and less than average Form III pupils. The production of TV and sound broadcasts was stopped in 1976 with the appointment of the officer in charge to Education Officer (Science) in May of the same year;

ii. the adoption and adaptation of a number of UK-published science projects among which are *Nuffield Physics* (1966a), *Nuffield*

Chemistry (1967), *Nuffield Biology* (1966b), *Nuffield Secondary Science* (1971), *Scottish Integrated Science* (1971) and *Science 5/13* (1972). A Malta edition of *Science for the Seventies* was also published in 1971 (Ventura, 1985); and

iii. the intermittent production of locally-produced worksheets started with the setting up of a Science Syllabus Committee in 1975 under the chairmanship of Dr.C.E. Fitches, Science Advisor. The production of worksheets has since then been characterized with sporadic efforts. Its main obstacles were:

a. the short time allowed for the receipt of suggestions/comments by practising teachers and the printing of worksheets to be made available in time for use at the beginning of the scholastic year. The first communication by the Science Syllabus Committee dated 2 March 1976 and addressed 'To All Science Teachers' had the following concluding paragraph:

> 'Finally, remember that time is of the essence - you will be using this course (proposed Integrated Science Syllabus, based on the London examination syllabus) next October, and we will have to work out detailed teaching schemes, prepare materials, etc. before then. It is very important for us to have comments and suggestions as early as possible';

and

b. the choice of the members to sit on the committee. Up to 5 May 1988, participants were handpicked by Education Officers from among practising teachers in secondary schools. Through Circular No.95/88, dated as above, a call was made by the Education Office for experienced teacher-volunteers to help in the organization of in-service training. The response to this call is not officially known.

However, what actually happened is that the same group of teachers who helped run the in-service course planned are now engaged in the production of a new series of worksheets.

In Malta, education in general and science education in particular, have grown and developed within a system structured and organized on a peculiar model. The situational process (pattern of positions and functions) and process structure need to be understood. This is what the next chapter will focus upon.

CHAPTER TWO

THE SYSTEM: STRUCTURE AND ORGANIZATION

2.1 The Administrative process: how it developed

Educational systems exist within social and political systems. The socio-political background of the Maltese system of Education has already been briefly traced in section 1.1 with the purpose of identifying special features. Lack of continuity and the prevalent tendency towards adaptation of foreign curricula rather than the development of local projects have been emphasized. However, a third feature, resulting from these other two characteristics can be included within the context of this section.

As an ex-colony, in its widest historical sense, Malta possesses an administrative system similar to that described by Johnson (1973) as

> '[a] historical convergence of two cultures: that of the colonised and the colonisers.....providing the apparatus for the subjection of one to the other' (quoted in Farrugia, 1985b).

It is not difficult, then, to deduce that the administration of the Maltese educational system is both hierarchical and bureaucratic. It may be added, however, that, while the administration centrally controls the decision-making process, efforts have not been lacking

throughout the years to decentralize the procedure. The extent to which these efforts have proved fruitful and practical can be gauged by reviewing the development of the structure and organization of the system.

On the grounds of fostering general interest and greater welfare among the citizenry and of widening the small circle of decision-makers, arguments for both centralized and decentralized control have been voiced (Malta Union of Teachers, 1967 p.20; Lewis, 1967 p.16; Cameron, 1970 pp.31-32). Both concepts, centralization and decentralization, stress the issues of power and authority. The centralized organization provides opportunities for higher status and privileges, may give rise to the manipulation of policies and controls financial issues; the decentralized organization encourages wider participation, allows a higher degree of autonomy and shows more efficiency in responding to immediate needs. Because of the change from patronage to independence in the political history of the Maltese islands, attitudes have changed somewhat. However, the inability to eradicate the inherited and institutionalised colonial influences on the one hand and the inability to control the amplified voice of a national conscience towards a cultural identity on the other still persist.

Political independence in 1964 was preceded by an era dominated by high-handed top-to-bottom administration. Teachers were insufficiently trained, poorly paid and belittled by their superiors.

Starting with a University Rector-cum-Director of Education as head of the Education System in the mid-1800's, the Department of Education passed through thirty years (1850 - 1880) of domination by Dr.P. Pullicino as Director of Education. His successors mirrored his legacy. Improvement in attitudes was registered after 1913 when the Department of Education and the University became two separate entities. This positive trend was further improved in the post-World War II years with the recruitment of higher officials in the Department coming from the teaching ranks (Farrugia, 1985b).

Following Independence in 1964, a different view of the situation was taken. The emphasis on a more egalitarian concept of administration was not lightly opposed by those assuming a privileged position both in terms of authority and control over financial matters and in terms of the direct administration of the Education Department (**Tomorrow**, March 1983 pp.4 - 7, quoted in Farrugia, 1985b).

It is not surprising then that a system has evolved whereby, up to 1963, a Chief Clerk and an Accountant were officially recognised as forming part of the Administration of the Department of Education. (*Malta Yearbook* 1958-1963). Moreover, the Department's team of inspectors lived up to their official designation by regularly inspecting and reporting upon teachers and headteachers.

Two general factors seem to dominate the administrative process of the Education System:

i. the diarchy of the government of education where two independent authorities govern from within and from outside the Education Department. In its *'Report on Education in Malta'*, the Malta Union of Teachers (1967) refers to 'cumbersome machinery' (p. 20) in dealing with official matters. While within the Education Department 'matters of great importance take an unduly long time before they are thoroughly dealt with', there is 'interference from other departments ostensibly lacking in interest and adequate knowledge of educational matters' (p.21).

Obviously reference is here being made to the 'educationist administrators' and the 'non-educationist executive arm of the civil service' which Farrugia (1985) considers as being two of the forces competing for control over the system. This situation has caused a lot of harm because it has contributed to unnecessary delays and frustration in the purchase of educational equipment (Lewis, 1967 para. 42) and in other purely educational matters.

ii. the hierarchy within the Education Department itself. Up to 1974 the Director of Education was assisted by two Assistant Directors and up to five Chief Inspectors 'whose title is in practice a misnomer for none of them inspect' (Cameron, 1970 para. 34). There were 21 Inspectors, 4 of whom performed administrative rather than inspectorial duties. With the reorganization of the Teaching Grades in 1974, the Inspectorate was reorganized into Education Officers, 31 of whom were appointed to advise, co-ordinate and

organize work with various officials of the Education Department and with schools. The post of Chief Inspector was abolished and three Assistant Directors of Education were appointed two of whom had previously acted as Chief Inspectors (*Reorganisation Agreement on Teaching Grades*, 1975).

Some other arrangements had been recommended as early as 1967 by the Malta Union of Teachers (1967), Lewis (1967) and Cameron (1970). Among them one could mention the appointment of an Education Officer in charge of Educational Planning, the allocation of subject specialists among the inspectorate ranks and the updating of laws concerning education.

Whether the changes brought about by the Education Act of 1974 and that of 1988 have helped towards the increased efficiency and effectivity of the administrative process is beyond the scope of this section. However, it needs to be pointed out that both legislations have confirmed what the Education Act of 1946 proffered, namely, that Education is organized, controlled and administered by the Minister of Education through the Department of Education and other governmental and non-governmental bodies (Holmes, 1983).

In this respect the government of education is not limited to general governance such as Compulsory Education, Free Education, Licensing of Private Schools, Religious Instruction and freedom of conscience. It is much wider and deeper in effect. Article 11 of the Education Act

of 1974 and Article 18 (1) of the 1988 Education Act go a long way to define in clear terms the 'unbridgeable divide [that] separates [Maltese teachers] from the educational authorities' (Farrugia, 1985b) and the fact 'that Education Officers are hardly ever asked for their advice' (a response from Questionnaire A to Q.8 - Appendix). Article 18(1) (Education Act, 1988) is reproduced in full hereunder:

> 'Subject to the provisions of subsection (2) of this section, it shall be the duty of the Minister to establish the curriculum for State schools and he may establish different curricula for different State schools'.

As pointed out earlier (p.36), efforts - even in legislative terms - were made to decentralize the decision-making process. In fact, Education Act 1974 provided for the setting up of an Advisory Council for Education and for a Commission for the Development of Higher Education; while Education Act 1988 establishes School Councils, a Scholastic Tribunal, a Council of Education and the handing over of the responsibility for the conduct of all State Schools' and public examinations to the Registrar of Examinations.

It may be concluded then that the development of the administrative process of the education system has been characterized by a tug-of-war between traditional colonial influences and shared control overtures.

2.2 School Differentiation and the Science Curriculum

Secondary education for all introduced in October 1970 brought about a break from the traditional dominance of grammar school thinking. As indicated earlier, in the period 1958 - 1969, secondary school education was limited mainly to grammar and technical schools and the science curriculum evolved around the three main subject compartments of biology, chemistry and physics with a view of the GCE 'O' Level terminal examination. Consequently, the main agency responsible for any significant change was the publication of popular textbooks or perhaps the official report issued by the delegacy responsible for the setting of the examination paper following the publication of results. The majority of grammar school students were prepared for 'O' level examinations set by Oxford University.

As the secondary school population increased dramatically in the scholastic year 1970/71, other agencies of change came into play. Among the more important ones were the following:

i. the increased diversification of learning experiences as a result of the rate of growth of school differentiation that followed, namely, area secondary schools, the remaining grammar school classes, trade schools and later the return of selective grammar-type junior lyceums;

ii. the adoption of the *Science for the Seventies* (Mee et al, 1971) course prepared by a Working Party on Secondary School Science in Scotland (Scottish Education Department, 1969);

iii. the launching of the Nuffield Science Teaching Project by the Nuffield Foundation of the United Kingdom in the early 60's;

iv. the setting up of the Malta Integrated Science Project in 1976 (Education Circular 5/76, 1976); and later

v. the decision to introduce compulsory Physics.

The complexity and diversity of the science curriculum at this initial stage of rapid change represents the attempt made by the education planners and curriculum developers to satisfy the numerous and often competing demands made on schools. From a review of the measures taken by the administrative side of the Education Department and the effects produced in the teaching-learning process (Ventura, 1985), confirmation can be obtained that this was a classic example of recourse to adaptation as an agency of change - a feature of the Maltese Educational System highlighted in Chapter One.

The decision to adopt *Science for the Seventies* involved major issues. The positive evaluation comments on the Scheme published by the Scottish Education Department, 1969, may have been highly influential (Ventura, 1985); local science television programmes, mainly *Science One*, provided complementary material; and the Education Department scored a financially favourable deal in negotiating for a Malta edition of the course. The issues involved, therefore, covered a wide range of educational and financial risks with long-term effects. The course remained on the local scene for a period of ten years notwithstanding the intrusion of other material

and the difficulty encountered with the language of the pupils' books and the amount of subject matter that had to be covered.

Among the catch phrases which may have influenced the succession of decisions taken by local educators during the same period with respect to the Nuffield Science Teaching Project, one would perhaps be tempted to include the following:

> i. 'In all these programmes the principal aim is to develop materials that will help teachers to present science in a lively, exciting and intelligible way.' (Director of Nuffield Foundation in Foreword to *Nuffield Biology 1966, Nuffield Chemistry 1966* and *Nuffield Physics 1967*); and
>
> ii. '[the emphasis is] on learning rather than on being taught, on understanding rather than amassing information, on finding rather than on being told.' (*ibid.*)

'Nuffield' ideas may have been imported from two sources: i) the expatriate science advisors and ii) teachers sent to the United Kingdom on scholarship to follow courses in science education then mainly influenced by the impact of the Projects. Two particular features which have broadly hindered the full implementation of these Projects locally were the financial burden their implementation incorporated due to the large amount of material - books, apparatus, films - required and the break with tradition that teachers had to make in order to 'do' Nuffield. The same situation prevailed in the United Kingdom. Large-scale implementation cannot succeed when it becomes clear that some were " 'doing' Nuffield, others 'using it' and a third group seeing no use for it with their pupils" (Booth, N. 1975)

A solution to this complex situation was sought in the setting up of the Malta Integrated Science Project in 1976. Unfortunately, this venture was doomed to fail for the same reason that the proposed syllabus for the new secondary schools (1970) failed. While Secondary Education for All was originally meant to provide secondary education free from selectivity, the stated aim of the proposed syllabus was to cater for pupils intending to sit for their GCE 'O' level examination as well as for those who did not intend to do so (*Workings of the Education Department*, 1970). Similarly, the Malta Integrated Science Project was a high level course that followed the GCE 'O' level Integrated Science syllabus of the London GCE Board. Besides, this project involved the preparation and publication of worksheets by volunteer science teachers. Human and financial resources were not available in enough quantity to see the project through to its completion; apart from the fact that both 'the subject matter and language level of the worksheets were too difficult for most pupils' (Ventura, 1985).

The fifth agency of change in science curriculum development was the introduction of compulsory Physics in secondary schools as from the scholastic year 1979/80 to coincide with the re-introduction of the grammar-type junior lyceums. The decision on Physics was taken in 1979 and ten years later it is still in force. Rather than being considered as a change agent in the development process, it may be classified as a unilaterally-imposed restriction which helped in no small way to single out the main feature of the development of the

secondary science curriculum; namely, 'adjustment'. In this age of electronics, Physics is indispensable; then make it compulsory!

The overall situation can be interpreted as the return to the state of secondary school prior to the 1970 event. As far as learning opportunities are concerned, secondary school students are being offered the same choice of preparing for the GCE 'O' level examination with a relatively minor change adopted in 1974 whereby the official secondary school science syllabus is based on the London examination rather than on that of Oxford. Some students, particularly in Physics, opt to take both examinations in search of a pass. In the case of the Integrated Science course taken during the first two years of the secondary school, use is once again being made of locally-produced worksheets to supplement and, maybe, eventually replace imported source material.

Once the decisions to diversify schooling and to differentiate between the needs and interests of the students have been taken, curriculum developers, working within an established framework of a central administration, can only attempt to create strategies and adjustments that appear to help in achieving the desired aims. Such strategies and adjustments usually lead to an overemphasis on examinations and the adoption and adaptation of established courses. This is why school differentiation and the development of the science curriculum have been discussed in conjunction with each other.

CHAPTER THREE

ESSENTIALS OF MANAGEMENT

3.1 Management Theory

The first two chapters of this dissertation have been concerned with the growth and development of education in Malta and with the development of the system in terms of administration and school differentiation. A view of the situation has been taken as an ongoing process characterised by a number of decisions giving priority to political, sometimes economical and, on other occasions, to educational considerations. Since decision-making is the ultimate task of a manager, the essentials of management will be the main focus of this chapter.

Although management as a field of study has a relatively short history, many definitions of it have been advanced. Some writers define it in terms of its effect: 'Management is the basic integrating process of the organizational activities that surround our life' (McFarland, 1974) or '...co ordination of all resources through the process of planning, organizing, directing and controlling in order to attain stated objectives' (Sisk, 1973). Others refer to management as '...a distinct process....performed to determine and

accomplish stated objectives by the use of human beings and other resources' (Terry, 1972) or '...the sequence of related processes whereby activities are planned, implemented and monitored in order to achieve the objectives of the organization as efficiently as possible' (Commonwealth Secretariat, 1981). For the purpose of this study, the definition stated in the Introduction and Rationale (p.3) will be retained; namely, 'Management is the means by which co-ordination for the achievement of desired goals can be realised'.

Three common themes in all the definitions given can be identified:

i. Management is a process used to achieve stated objectives;

ii. A series of tasks needs to be performed in the process;

iii. Resources, both human and others, form the basic material used by managers in their effort to co-ordinate activities.

Furthermore, there are two important implications:

i. There are different styles of management, and

ii. The concept of management is closely linked to that of leadership.

Historically, the manager's task has been viewed as closely related to the way managers treated people and to the type of people with whom they dealt. The traditional view assumed a negative, pessimistic view of the individual. People were considered as lazy and incapable of self-discipline and were not motivated in any way. They could only be managed by decree and conformity to tradition. As the industrial revolution spread, technology became more sophisticated

but the skills of the workers remained low. Early in the 20th century (1911) Frederick Taylor and Frank and Lillian Gilbreth proposed that the objective of management should be securing the maximum prosperity for the employer and employee. This could be achieved by studying a job scientifically so as to determine the one best way it could be performed and then to teach this way to all employees in the job. Thus was born the Scientific Management School of Thought bringing about a shift from the autocratic style of management to the 'benevolent autocratic' style.

As a consequence of this development, researchers started to realize that motivation to work and the quality of work were related to the nature of social relations among workers and between workers and their managers. The classical studies on the 'Hawthorne effect' (late 1920s and early 1930s) led to greater emphasis on human needs and motives. Although severely criticized on several grounds, but mainly on the non-scientific approach taken, this study led to the development of the Human Relations Management School of Thought. The shift in management style was now towards 'consultative management'. This new position was labelled by McGregor (1960) as Theory Y in contrast to Theory X (the classical theory). While Theory X assumed that people must be controlled and directed towards the stated objective, Theory Y emphasises people's intrinsic interest in their work and their desire to be self-directing and responsible.

What was actually emerging from this kind of progress may be considered as an awareness of the component, interacting parts involved in the management process. Concern could no longer be directed solely towards material gains or towards the psychological needs of the persons involved. Some type of structure, in which elements interacted and communicated, was implied. The Systems Management School of Thought is the emerging school whereby human resource management is the main approach (Douglas, 1971; Davies, 1975; Duncan, 1978; Education Dept., Malta/Unesco, 1983). Genuine participation is now the chief characteristic of the style of management that is being adopted.

Although three schools of management thought have been distinguished, it should also be recognized that it is practically impossible to neatly distinguish among them. They are not exclusive of each other; they are rather constitutive in the sense that one has emerged from the other. Conceptually, management theory and practice cannot be seen as being exclusively scientific, behavioural or systematic. 'Management.....is a synergistic field' (Duncan, 1978). Today's managers must comprehend the essentials of individual and group behaviour; they must understand administrative processes and they must be familiar with mathematical and statistical procedures. Management has combined many aspects of a number of disciplines into a new field of study and practice.

3.2 Functions of Management and Leadership Styles

Most basic texts on management describe five basic functions which all managers perform: planning, organizing, staffing, directing and controlling. They perform these functions within a decision-making framework in order to reach the goals of the organization to which they belong. A manager can be viewed as 'a specialist in the art of decision-making' (Massie, 1971).

The decision-making process of management is affected by the environment of the decision-maker and the role that she or he assumes. Decisions are made with regard to the various resources available, that is, human resources, financial resources, physical resources and information. The complexity and vastness of these four 'inputs' require of the manager three important basic skills regardless of the kind of organization. In education, the need of human relations, technical and conceptual skills is broadly self-evident. Whatever the level at which one manages - teacher, headteacher, education officer, director - one needs these broad skills if one is to be effective.

It is the aim of this section to underline the close link that exists between the functions of management and the skills of managers; between the concept of management and that of leadership.

Within the context of this discussion, it is only possible to present a few selected theories of leadership behaviour and a few concepts underlying the styles of leadership proposed in management literature. Moreover, the functions of managers will be outlined rather than dealt with individually and at length. The purpose of this approach is to highlight the element of integration between management and leadership in a simple, concise manner.

As with management, there are almost as many definitions of leadership as there are writers on the subject. Some define it in terms of the role the leader plays and others define it functionally (Gouldner, 1950, and Laidlaw, 1972, quoted in Duncan, 1978); and some see leadership as a process of influence (Stogdill, 1974). Early research has often tried to analyse leadership in terms of the physical characteristics of the leader. The assumption was made that there are certain characteristics that distinguish leaders. Such an assumption is the traitist view. Later psychological characteristics were also surveyed. Studies have tended to favour the idea that there are certain patterns of personality traits in effective leaders., This behaviour approach implies that such behaviours as consideration, responsibility and tact are identifiable with what a person does when he or she is leading. The point has been made that people do not become leaders because they possess certain traits. Rather, they may behave as leaders if the situation requires them to exercise leadership. Consequently, the alternative explanation that leadership is a function of several variables including not only the

characteristics of the leader, but the characteristics of the followers and the general situation as well has been developed. This situational approach implies that 'different situations require different leadership behaviour (Darmanin, 1985 p.95). More recently, however, research is showing that both certain characteristic traits and behaviours are essential in particular situations (Stogdill, 1974; Dubrin, 1974).

Darmanin (1985) holds that the traits-, behaviour- and situations-approach cannot be considered in isolation. 'Personality traits, leadership behaviours and the situational context are all utilized and activated through the learning, acquisition and practice of skills' (p. 98). This is why he prefers the skills-approach based on Hall's (1980) notion of a skill in terms of value consciousness.

As pointed out is section 3.1, the overall task of management is the accomplishment of organizational goals. 'Ideally, managers should be good leaders and capable of influencing group behaviour' (Duncan, 1978). It is, therefore, relevant to consider at this stage the different styles of leadership that have been identified by various researchers.

Tannenbaum and Schmidt (1958) (Hull and Adams, 1981, pp. 37 - 42; Darmanin, 1985, pp. 30 - 31) propose a continuum of leadership styles ranging between the extremes of laissez-faire and autocratic. In a pure laissez-faire system the leader would exercise no direct

influence over group behaviour, while the autocratic leader exercises complete control over members discouraging participation in the process. In between these two extremes lies the democratic leader who makes ultimate decisions about goals and goal accomplishment but allows group members to participate in both processes. Likert (1967) classified two basic leadership styles: job-centred (task-oriented) and employee-centred (people-oriented). Likert's findings have made a major contribution to the important link that exists between management and leadership. He developed a continuum of organization structures based on several factors. The factors used as a basis for classification are: i. leadership processes, ii. motivational forces, iii. communication processes, iv. interaction-influence processes, v. decision-making processes, vi. goal-setting processes, and vii. control processes. Classification according to these criteria characterizes organisations as having a System 1, 2, 3 or 4 structure. Likert holds that high performing organizations are almost always the System 3 or 4 type. Table 3-2 (Duncan, 1978,p.211) provides a comparison of the characteristics of the four systems. It will be noted that the factors considered by Likert are synonymous with the major functions of management.

Another important aspect of leadership is that concerned with how one becomes an effective leader. Fiedler (1967) (Duncan, 1978, pp. 214 - 218; Darmanin, 1985, pp. 19 - 22) tried to synthesize both the source-of-leadership and the styles-of-leadership controversies by developing a 'contingency theory of leadership'.

Table 3-2
Comparison of Selected Characteristics of Various Systems Based on Likert's Continuum of Organization Structures

System	Leadership	Motivation	Communication	Interaction and Influence	Decision Making	Goal Setting	Control
1	Managers have no trust in subordinates	Concentration on lower level needs	Very little	Little and founded on fear and distrust	Nonparticipative	Set by orders and directives	Control by top of organization
2	Managers have some confidence and trust in subordinates	Some recognition of higher level needs	Some	Little, with less fear and distrust	Some decisions made at lower levels but with clear direction from the top	Limited opportunity to give opinions	Mostly from the top
3	Managers have substantial trust in subordinates	Acknowledgment and appeal to higher level needs	Substantial	Moderate, with substantial trust	Policies made at top, specific decisions passed down	Employee input allowed	Some sharing of responsibility with lower levels
4	Managers have complete confidence and trust in subordinates	Recognition of all motives	Much	Extensive and free	Through all levels and integrated through linking process	Participative	Concern for control through the entire organization

Source: These points selectively adapted from Rensis Likert, *The Human Organization* (New York: McGraw-Hill, 1967), pp. 197–211.

According to Fiedler, leadership is a personal relationship in which one person directs, co-ordinates and supervises others in the performance of a common task. Leader behaviour refers to the specific acts in which a leader engages while directing and co-ordinating work. Leadership style refers to the underlying needs of the leader which motivate his behaviour. These definitions point towards Fiedler's contention that 'leadership is contingent on the personal characteristics of the leader and on certain situational factors, the latter defined in terms of how much control the leader can exercise over the situation' (Darmanin, 1985 p.19).

Two important points emerge from this brief survey of leadership theories:

i. Leadership is a function of the organization; that is, a leader, whether seen as good or bad, cannot act in isolation. A good leader is also dependent upon good membership - she or he is a good leader because she or he is accepted as such; and

ii. 'Leadership has a unique obligation to manage the relationships between a system and the environment in which the system finds itself' (Massie, 1971).

Of the five basic functions which all managers perform, directing is at the heart of the managerial process because it is involved with initiating action. In directing, more than in any other function, the manager must determine his own approach after surveying the possibilities available and after having prioritized his functions

within the decision-making framework. As Anthony (1978) puts it: 'Directing is the leadership function in the organization.' The four other basic functions have an equally determining effect., In fact, planning decisions involve determining what is to be done and how it is to be done, while organizing decisions involve the determination of the amount and types of resources needed. The manager must ensure that they are available in time and in place as needed. Staffing decisions involve the selection, placement and training of human resources. Finally, controlling decisions are made to ensure the evaluation of the work undertaken by the organization. All the functions performed by managers can be considered as forming what has been termed as the 'Management Control Loop' (Commonwealth Secretariat, 1981). Within this loop the functions can be classified under two separate but mutually dependent processes, namely; the feed-in process (planning, organizing and staffing) and the feed-back process (controlling, evaluating). Central to the process as a whole is the achievement of the stated organizational objectives. In order to ensure effectivity, the manager needs i. human relations skills which should reflect his ability to interact with people, ii. technical skills to help him manage the operation and iii. conceptual skills which are the planning, organizing, staffing, directing and controlling skills already discussed. The degree of the skill required then depends on the level at which the manager functions.

3.3 Management approaches adopted

The content of this section is based on the questionnaires sent to officers serving in the Education Department of Malta and to the Malta Union of Teachers' (MUT) administrative secretary. The officers at the education department were the three science education officers and the education officer in charge of planning. The questionnaire was sent towards the end of the first half of the two-year period spent on this study. In the covering letter sent with the questionnaire, it was suggested that I would call for the completed answers in three weeks' time. The date was specified and a request for a follow-up informal interview was also included. The number of questions varied between thirteen and fifteen and space was allotted for the answers to be written therein. A copy of the three different questionnaires is included in the Appendix.

Because the education system of Malta is a small enterprise, the number of persons involved was only five. Moreover, the posts occupied by these persons (with the exception of the MUT's administrative secretary) can be considered as having been monopolized by themselves in the sense that such posts did not exist in the pre-secondary education for all period. The key positions they hold easily identifies them and so I bound myself to ask their permission if I were to quote parts of their responses. However, in order to avoid causing any inconvenience, I shall refrain from specifying from whom the responses were obtained. Instead, a general

analysis of the picture I formed about the management of education in general and science education in particular will be given. Since the time when the questionnaire was sent, two of the officers have changed their job and another one has retired from service.

It is also relevant to point out that the number of years of service in the post the officers held at the time were as follows: 19 years, 15 years, 14 years, 12 years and 10 years. Together with the views I elicited from the questionnaires/interviews, I shall add points of personal experience following 13 years as teacher of science subjects in secondary schools and 8 years as head of department (science).

Finally, the information and relevant facts given in the previous chapters about the growth and development of education in Malta should be considered as the framework within which all concerned were functioning.

The questions presented to the education officers can be grouped into four categories, namely:

i. job specifications;

ii. management functions;

iii, job satisfaction; and

iv. management education received.

The administrative secretary of the MUT was asked two different sets of questions: one concerning the union's views/recommendations about

the duties of education officers, headteachers and teachers, and the other about curriculum/staff development.

The reactions obtained were the following;

i. one of the questionnaires was returned by post and blank within a week together with a note of regret that the 'respondent' did not wish to participate in the project nor to discuss the matter any further;

ii. another one was returned by post filled in with one-word answers or short phrases. A message was left at his office to the effect that an interview was not deemed necessary. When contacted by phone later, this individual replied that "there is nothing to add; after all, we have been working together for.....years."

iii. a lengthy, 15-page word-processed reply was delivered by hand by the person himself to my office at the school where I was working at the time. Two one-hour long interviews were later held at the office of the individual concerned;

iv. the two other persons informed me by phone they they do not really have the time to answer the questions in writing. They would prefer an informal interview: one invited me to his office for a two-hour interview by appointment, the other invited me to his house to discuss the whole questionnaire informally over a drink. This session lasted three hours.

My impressions at this stage about the work performed by education officers confirmed what I had experienced as a teacher and as head

,of department. Collaboration between officers working in the same field was to a large extent inexistent. Science education was being managed by individual effort following instructions given by superiors. Since participation in the decision-making process at higher levels was not practised, reactions in the implementation stage varied from indifference, benevolent acceptance and the cosmetic flair of personal competence.

All respondents felt accountable to their immediate superior because they were presented with *post facto* decisions. All their energy had to be expended in infrastructural organization. "Keeping records of textbooks in schools, dealing with maintenance of science laboratories, collecting statistics about teachers and pupils and dealing with complaints were the order of the day." Perhaps all this could be the result of another flaw at a higher managerial level. The duties of the officers concerned were specified in the call for applications. These included, among others, two outstanding items: i. to ensure that the policy of the department is efficiently carried out; and ii. any other duties compatible with the post. In fact, these two items follow a list of six others dealing with advice, organization and information required by the Director of Education (Education Circular and 94/88). Rather than being surprising, the three replies given to question no.2 of the questionnaire concerning the terms of reference of the post held were a confirmation of the management functions being adopted. The three replies were: 'nil', 'they were originally published, but they have been shifted from time

to time mainly, I feel sure, to accommodate personalities and to avoid personality clashes' and 'to improve the teaching of .....'. Understandably, then, education officers feel that they have a certain amount of freedom regarding resources of infrastructure, though heavily circumscribed by the Treasury; they have complete freedom to take decisions at the implementation level of a project (opening of a new school, curriculum development within the overall 'O' level syllabus, staff development and setting of examinations). On the other hand, this assumed freedom vanishes into thin air when considered alongside the main constraints education officers themselves sense. Apart from non-participation in decision-making and financial limitations, the following restrictions were also mentioned:

i. Most, if not all, decisions taken are political in the sense that 'people other than those officially employed' are involved;

ii. agreements negotiated by Government with the Malta Union of Teachers have to be respected; and

iii. evaluation is only seen as a measure of the percentage of passes in examinations at all levels.

Reference to the influence of the MUT was taken up with the staff working with the administrative secretary. Unfortunately or rather, on reflection, as a result of the ingrained negotiating diplomacy of union leaders, all the answers given referred to the recommendations made to government and to the education department throughout the years. Most of the recommendations have been accepted and were

included in the Reorganization Agreement on Teaching Grades signed by government and the MUT on 2 July 1975. Other recommendations had, at the time of the interview, not yet been accepted. Since then a new agreement was signed on the 2 June 1989 and some more recommendations were included. Among others, these included the appointment of an Education Assistant and that of a Principal Education Officer. A new post of responsibility (Safety Teacher) was also created.

Strictly speaking, the overall picture given by the managers directly involved with the development of science education did not change. No mention is made in either of the two agreements of the process of management. Emphasis is laid on the more popularly accepted trend of improving the conditions of work and promotion in terms of seniority, efficiency and wage structure.

It must be emphasized at this stage that heads of department, headteachers and teachers are not to be excluded from the realm of management. With the system of education in Malta the same hierarchical conditions prevail at this level as with the top management level. Within the school - considered as functioning at the middle management level - the same networks of communication and levels of freedom in participation and decision-making hold. As a teacher of science subjects, I was free in the choice of pedagogical methods to be used. I could freely experiment with, review and change my methods at will provided my students obtained what my

immediate superiors termed as good results. It was only as a personal initiative and commitment to my profession that I worked in collaboration with my colleagues and my superiors for the betterment of science education. I was never involved in giving my views before decisions were taken, although very often I was asked to help on a voluntary basis with the organization of science laboratories, with development of science syllabi and the setting of examination questions. The same approach applied while I held the post of head of department (science). On the other hand, I could more freely adapt different managerial processes within the limits of the department. Decisions relating exclusively to the science department were normally taken collectively within the department. Schemes of work, ordering of laboratory equipment, assessment procedures and time-tabling were not discussed with the headteacher.

The last category of questions asked concerned the type of training my respondents had with respect to the post they occupied. Both pre-service training and in-service training were discussed. The answers given were brief and significant because of the light they throw on the need of management education. The following replies were given: i. 'none', ii. 'hardly any, except for two poorly organized in-service courses supposedly about management', iii. 'academic training at University' (incidentally not concerned with science education), and iv. ' a one-year course of training abroad'. The obvious reply to my question about the need of training has been that it is absolutely essential.

What cannot be left unsaid at the end of this chapter is the prevailing sense of embarrassment felt by all concerned with this exercise. As already pointed out the respondents accepted to a different degree the risk of losing their anonymity. Perhaps, it would not be out of place to point out that, as far as the managers of science education during the period under review are concerned, there is good material for enhancing the situation if proper training is given and if the system were less bureaucratic.

CHAPTER FOUR

TRENDS IN SCIENCE EDUCATION

The events occurring in the development of science education throughout the world during the last thirty years (1958 - 1988) provide examples of planned innovation. They reflect changes brought about as a consequence of political, economic and social affairs. Moreover, an element of dissatisfaction with existing conditions and an increasing interest in education have also contributed to the various shifts of interest and concern about the quality of science education being provided. An overall awareness of the changing needs and values of society has been generated. As a result of the rapid advance of scientific knowledge and the emergence of significant technological developments, changes in our life-styles have also occurred. All this suggests that new and improved ways of teaching and learning science had to be devised.

The development of science education in Malta has already been dealt with in Chapters One and Two. The extent to which this development concurs with improvements sought abroad needs to be considered. Although the discussion is limited to projects which have been judged as being relevant to the local situation, the aim of this chapter is

to provide a comparative and contrasting background for local strategies.

The period of time under consideration can be conveniently divided into the three decades it comprises, that is, the 1960s, the 1970s and the 1980s. The first two decades were characterized by a specific change agent and by the production of science teaching projects. The 1980s have witnessed an increase of research into and the development of the integrating process of science and technology with special reference to information and communication. Although reforms and improvements were evident in many countries, the pioneering work carried out in the United States of America and the United Kingdom produced a catalytic effect which was felt throughout the western world. The National Science Foundation (NSF) of the United States and the Nuffield Foundation of the United Kingdom were the principal funding agents of the 'first generation projects' (Baez, 1976) started in the late 1950s and early 1960s in the two respective countries.

The approach to reform in science education in the eastern world was characteristically different. Pedagogical institutes and academies (Pedagogical Institute of the Ministry of Culture and Education, Hungary; Czechoslovak Academy of Sciences, Czechoslovakia; Central Institute for Educational Research of the People's Republic of China) were created with the specific task of reappraising existing science

curricula and with developing new approaches (Baez, 1976; UNESCO, 1987a, 1987b).

It is widely accepted that the launching of the first orbiting satellite - Sputnik - by the USSR in 1957 had a wide-ranging and deep effect on science teaching (Lewis, 1971; Baez,1976, 1986a; UNESCO, 1980, 1983; Lehrke et al 1985; Matthews, 1988). Sputnik did not, in effect, launch the reform. However, as a major technological achievement, it certainly contributed towards the extravagant financial support showered by the US Congress in the 1957 Budget - five million dollars more than requested (Baez, 1976) - on the NSF. The Foundation had, in turn, been funding the Physical Sciences Study Committee (PSSC) under the direction of Professors Zacharias and Friedman - two eminent physicists - who, a year earlier (1956), had made what proved to be a most effective call for reform. The main concern of educationists, at the time, was with the content of the syllabus. The projects, or teaching programmes, were usually discipline-centred; that is, they stayed within the boundaries of biology, chemistry and physics. 'Any new material could then so easily be taught by dogmatic assertion' (Lewis, 1971). What the PSSC programme was suggesting was a shift from concern about matter to more concern about method. The need was felt for a complete programme rather than a new syllabus. The programme included the production of textbooks, a teacher's guide, a laboratory manual, a series of background books, new apparatus, films, test papers and examinations. Within a few years, other complete programmes were

developed. These included the Chemical Education Material Study (CHEMS), 1963 and the Biological Science Curriculum Study (BSCS), 1963. It is relevant to point out that by this time a suspicion began to develop that the PSSC programme was too difficult and, perhaps, not suitable for the average student. In addition there was a growing feeling that the projects were too strongly single-discipline oriented (Baez, 1976; Unesco, 1980).

A very similar pattern of development was taking place in the United Kingdom. During the same year of the launching of Sputnik, the Association for Science Education (ASE) was encouraged by the education authorities to look critically at syllabuses in Physics, Chemistry and Biology, and to make recommendations for the future (Lewis, 1971, p.103). At the time the main concern was with science teaching in the grammar and public schools (ASE, 1979 p.11). The principal recommendation made by the ASE was for new syllabi which reflected the need for better science teaching - a shift from content to method. It is interesting to point out that the call for reform was made by teachers rather than by scientists. It was here that the Nuffield Foundation decided to assist. Work on Nuffield science teaching projects began in 1962 and by 1971 ten different projects had been either completed or were in the process of completion. 'Nuffield Science set out to bring about a broad education through participation in and experience of the procedure of scientific investigation' (Malvern, 1980). The means by which this was to be

achieved was that of a complete teaching programme comprising the same type of supporting resources as used by the PSSC in the US.

Science education in the 1960s was then characterized (a) by innovation brought about by the recognition that science is more than a body of knowledge and by the desire to stay ahead in the technological race; (b) by curriculum reform and the preparation of teaching material; and (c) by an emphasis on understanding rather that rote learning. The encouraged teaching method was the Bruner-inspired 'Inquiry Method'.

The work originated by the NSF and the Nuffield Foundation in the 1960s continued to develop into the 1970s. Moreover, inspired by the work of curriculum groups in the United States and in Britain, UNESCO launched an international science curriculum development project resulting in the publication of the *New Unesco Source Book for Science Teaching* (1973). Consequently, UNESCO, together with the Nuffield Foundation, became the major change agent for the 1970s. Two important trends were set: a) a shift in emphasis in the reform movement towards the pre-secondary and early secondary school years, and b) an emphasis on the integrated teaching of the sciences. Work begun by the ASE - e.g. *School Science and General Education, 1965; Science and General Education, 1971* and the Schools Council e.g. *A School Approach to Technology, 1967; Changes in School Science Teaching, 1970* - (both in the United Kingdom) - gained importance mainly due to the radical changes proposed.

Reforms were not carried out without criticisms. In fact, critics of the early reforms of the 1960s contend that, for example, the PSSC and CHEMS programmes were designed largely by academic scientists with bright science-oriented students in mind (Baez, 1976); that 'when the Nuffield O-level courses were first planned .... it was not found possible to avoid the traditional division of school science into three subjects' (foreword to *Nuffield Combined Science*, 1970); and that 'the inductivist model of inquiry that they were based upon was known to be deficient, or at least highly controversial, even at the time the curricula were being implemented' (Matthews, 1988).

As a result of the evaluation that followed the launching of the original programmes, it seems evident that the need for integration was recognized early. In fact, *Nuffield Combined Science* for the whole ability range in the 11 - 13 age group, begun in 1965, was published in 1970. It was immediately followed, in 1971, by *Nuffield Secondary Science* intended for students not likely to take GCE 'O' levels in science subjects in the 13 - 16 age group.

UNESCO'S role as an organization leaned heavily towards the convening of international conferences about integrated science education and the publication of work by experts on the subject and of reports on new courses developed world-wide. Two of the more important meetings held were in Bulgaria (1968) and at the University of Maryland, USA (1973), While the first meeting tried to define the concept of integrated science in the light of what was being done by

its many practitioners, the second meeting dealt with the training of teachers of integrated science. Three volumes of *New Trends in Integrated Science* were subsequently published by UNESCO in 1971, 1973 and 1974. Very briefly, three main issues emerged:

i. The natural way to teach children is the integrated way;

ii. The concept of integrated science teaching is based on the parallel assumption that the universe has an inherent unity;

iii. The teacher using the integrated approach must accept his role as a provider of adequate experiences and materials which help pupils in the process of finding out.

On both sides of the Atlantic, then, the call for integration was loud and clear. The trend towards Integrated Science was based broadly on the concept of relevance. Whereas the 1960 projects emphasised the need of an appropriate method of teaching, projects born in the late 1960s and early 1970s called for 'integration within science and the integration of science with other subjects' (Harlen, 1986). Relevance was given a wide variety of interpretations. However, the main reasons put forward for the teaching of science in an integrated way fall under one of the following categories:

i. Philosophical: Since nature is unified, science can also be unified and so can the teaching of science (Baez, 1976);

ii. The needs of the learner: Psychologists have discovered that there is a 'logic of the child' which differs from the 'logic of the subject' so that courses need to be designed in relation to the child's intellectual development (Schools Council, 1972);

iii. The needs of society: If children and adults are exposed to science in an integrated way, they will get a holistic rather than an atomistic picture of science. This would help them to deal with problems originating from the application of science to human welfare (Unesco, 1983 p.40).

'Science 5/13' and the 'Schools Council Integrated Science Project' (SCISP) were two of the most innovative projects published in the United Kingdom in 1972 and 1973 respectively. The characteristics of the two projects underline clearly the reasons for teaching integrated science listed above. Moreover, together, they cover the whole age range and ability range in both primary and secondary schools. Also, their aims, objectives, rationale, content, approaches and methods are the result of a combined effort by the three change agents who (as a point of interest) have been associated with the development of science education in Malta.

'Science 5/13' is a project sponsored jointly by the Schools Council, the Nuffield Foundation and the Scottish Education Department. It will be recalled that the Working Party on Secondary School Science set up by the Scottish Education Department was responsible for the publication of *Science for the Seventies* (1971). This book was used in the secondary schools of Malta for a period of ten years.

The general aim of 'Science 5/13' is:

> '...to help children develop concepts of science **appropriate to their ages** and to assist children - through discovery methods - to gain experience and understanding of the

environment, and to develop powers of thinking effectively about it' (*Dialogue* - Schools Council Newsletter No.1 p.5, 1968 - my emphasis).

The objectives have been further arranged in stages so as to be compatible with Piaget's views of children's development from intuitive through concrete to abstract operations.

SCISP is a project of the Schools Council. It is a broad integrated course in science bringing in elements of sociology and social sciences as well as the physical sciences. It proposes that 'all pupils should study science at least up to O-level: scientific illiteracy is also [being] condemned' (*Patterns* - Teachers Handbook, Schools Council Publications, 1973). It was brought about out of a desire to eliminate the 'unbalanced curriculum' and the 'irreversible decisions within the sciences' (*ibid.* p 1) resulting from pupils having to make option choices at the age of 13. The integrating themes throughout the scheme are 'pattern searching' and 'pattern using to solve problems'. Students' thinking is based on three fundamental concepts: building blocks, energy and interactions.

The 1960s and 1970s have together witnessed a promotion of experimentation and innovation. An awareness for a meaningful life has been created because science has brought about many changes in man's life. Science has been viewed as a body of knowledge which, when applied wisely, can enrich man's lives in many ways. Education through science as well as education in science cannot be limited to a person's school years. From the beginning of the present decade,

emphasis has been placed on the application of science and technology education to the needs of daily life and the development of society. The integration process started in the 1970s has been carried forward into the 1980s and it will certainly be pushed further into the 1990s.

A characteristic of the trends in science education in the 1980s has been the development of two different but complimentary perspectives. During the first half of the decade the work originated in the previous ten years was further extended and consolidated, while a re-thinking about and a revaluation of science education started to gain ground in the later half.

Two important documents published in 1979 have set the tune to the kind of developments that were to occur during the following years. '*Science and Technology: A Five-Year Outlook*' was prepared by the National Academy of Sciences in the United States as part of a report to Congress (Unesco, 1983). It gives a summary of contemporary science - mainly, the Planet Earth, the living state and the structure of matter; and of contemporary technology - mainly, computers and communications, energy and materials. Science and Technology are viewed as agents of change and those who will enjoy the changes must be ready to learn. The demands on education will be for the acceptance of science and technology education as an integral part of general education.

'*Alternatives for Science Education*', published by the ASE in the United Kingdom, contained proposals with wide implications for the organization of science education. A variety of contexts within which scientific knowledge can be placed were classified as follows:

i. Science as science;

ii. Science as a cultural activity;

iii. Science and citizenship;

iv. Science in the world of work;

v. Science and leisure; and

vi. Science and survival. (p.38)

Furthermore three alternative models for organizing science studies were suggested. The distinctive characteristic of these models is the inclusion of courses in Biological Science, Physical Science and Earth Science. In the 'Notes and References' section of the document (p.61) the following point is made:

> [62] 'The introduction of the term "courses" is quite deliberate for we are not referring to "subjects" called biological science, physical science, etc. Each course would utilize appropriate concepts, skills and techniques derived from subjects such as biology, chemistry, physics, geology, meteorology, history, philosophy, sociology, etc.'

The underlying concern of the two documents is for the development of science, technology and society courses whereby students can be prepared - through an integrated approach - to behave in a socially responsible way. Three projects introduced between 1981 and 1983 have set the trend for the early 1980s. They are the *'Science in Society'* (1981) course for secondary school students in all the ability range and the *'Science in a Social Context'* (SISCON), (1983)

course - originally intended as a sixth form project but then accepted for both A/O level (JMB) and at CSE (Mode 3) - both sponsored by the ASE; and, on a national scale, the introduction of Technology as a compulsory subject in the Swedish nine-year primary school.

All three are reflective of a widespread concern about the impact of science and technology on society. Both ASE-sponsored courses include decision-making simulation exercises on a variety of topics. For example: the siting of, and choice of fuel for, a new power station in 'Science in Society' (Layton, 1986a) and the changing environment, ecology and pollution in SISCON (Solomon, 1983).

The futuristic perspective taken by the Swedish education authorities lies in the intended nature of the subject. First and foremost technology is seen as a part of everyday knowledge and everyday skill. It is seen as a subject which makes varied and meaningful leisure possible. Also, technology is described as a subject which should foster curiosity and creativity. Society needs to understand contemporary technology so that it can control its use. 'To study technology is, to some extent, to study culture' (Riis, 1985).

It is still early to measure the success of the implementation of these three projects. On the other hand, their impact on science educators is becoming increasingly evident. Contemporary writers - practitioners and philosophers - are arguing for the revaluing and

recontextualizing of science education within the parameters set by their planners. Now, that 'the reforms of the 1960s have run their course' (Matthews, 1988 p.68); that it is not possible to really understand science without understanding some philosophy, history and even sociology (Laetsch, 1987 p.10); and, that 'science education should develop an awareness that science offers the fulfilment of human needs by virtue of being a human activity' (Newton, 1988 p.10), what is required is a collaborative effort between historians, social scientists, philosophers and science educators in the conduct of research, the training of teachers and other science education personnel within the framework of a continuing education. The late 1980s are also witnessing the rise of the theory or constructivism in educational psychology. Also, a greater appreciation of the place of history and philosophy of science is being generated (Layton, 1986b, p.17). Novak (1987) is one of the exponents of the theory of constructivism. It is a Piaget-inspired version of the cognitive learning theory and it draws heavily on the work of Kuhn, Toulmin and Bachelard (Matthews, 1988).

Irrespective of the context within which science curricula originated or were subsequently adopted, the economic and social position of the country concerned could not be ignored. The decision taken to strengthen science education and the explicit objectives chosen for science teaching reform are, to a large extent, in the hands of politicians. It seems, however, that the time has come for both politicians and the managers of science education to understand that

together and to an equal extent they have the social responsibility to take realistic decisions. A national science policy which reflects worthy and achievable goals is what people deserve.

CHAPTER FIVE

APPRAISAL AND RECOMMENDATIONS

5.1 Limitations and Conclusions

This study set out to investigate those features in the educational system of Malta which have contributed towards the managerial processes adopted with regard to science education. The conclusions drawn cannot be considered definitive because of existing limitations and constraints. Among the restrictions encountered, the following are of primary importance:

i. The Maltese educational system is a small enterprise. The number of people involved in managerial functions - as perceived by the system - is very small. Moreover, the same persons have occupied the same position for a long number of years thus limiting further the variety of management and leadership styles adopted;

ii. no similar study has been undertaken and no official records of important events in the history of science education have been kept. Also, reports on the *Workings of the Education Department* have become increasingly concerned with statistical information and with the infrastructural strategies of implementation rather than with curriculum development (1966) or educational planning (1969); and

iii. the time and space limit imposed by the course of study, of which this dissertation forms part, have contributed towards the rigour of the analysis required. On the one hand, this proved beneficial for the elimination of irrelevant material; on the other, however, it has added to the anxiety about the danger of misinterpreting events due to the exclusion of certain information.

There are also self-imposed limitations. The main one relates to the fact that science education is not limited to State secondary schools. The content of this study only covers the intermediary section of the public sector of the system of education in Malta. Primary and tertiary science education would have enhanced both the amount and quality of material presented. Another area that would complement this work is the Private Schools sector.

Considering the observations made in the previous chapters, a number of general conclusions can be reached about the system of education in Malta and about the management of secondary science education during the last thirty years (1958 - 1988). The following are the conclusions:

1. The system of education in Malta is a hierarchical and conservative system. It is administered jointly by three executive bodies:

a) the Ministry of Education: according to law, the Minister of Education has the right and duty to represent the State in its

obligation to provide education to all Maltese citizens. Among other rights, the Minister may grant licences for schools to be established, to supervise schools, to grant teachers' warrants and to establish curricula for different state schools. He is assisted by a Secretariat and by a Public Relations Office;

b) the Education Department. It is headed by the Director of Education who must see to the implementation of government policy in education. The Director is assisted by a deputy (since April 1988) and by a number of assistant directors and education officers; and

c) the Civil Service component which is mainly responsible for finance, administration of personnel and maintenance. This section of the administrative side, which works closely with the Treasury, may be considered as having the final say in most of the implementation processes.

Very few significant changes have occurred in the organization of the system during the last thirty years. The overall view is that the Education Department is sandwiched between a political faction and a finance faction. All major decisions are taken at the very top, communicated to a lower level stratum at formal meetings and then shaped and re-shaped according to the financial resources available. This procedure applies also within the three executive bodies themselves.

2. Because there is no formal set of aims of education and because the stated aims have always emphasized national needs, the system has grown generally at the whim of politicians, occasionally guided by expert advice. Lack of continuity, adaptation and time-consuming procedures have become the main features of the local system. A number of instances highlighting these features were given in Chapter One.

3. Both '1' and '2' above have moulded the development of science education because, as already pointed out, the size of the education system does not allow for the presence of an effective, independent sub-system. The changes that have occurred in the science syllabi in conjunction with school development and school differentiation clearly reflect the administrative measures taken for the whole school curriculum. Adaptations of science syllabi developed abroad and attempts to publish locally produced material are typical of the endogenous growth of science education. Moreover, since no evaluation procedures were included in any of the innovations attempted, the success or failure of each attempt was always measured in terms of examination results. In fact, examinations dominate the whole system of education.

4. The concept of management does not seem to form part of the local educators' philosophy (Calleja, 1988, p.27; Bezzina, 1988, p.19). Education in general and science education in particular have suffered from the lack of clear objectives and from lack of

communication. Planning has been further obstructed by *ad hoc* decisions and even by the reversal of carefully thought out measures (Cameron, 1970). Positive results, however, have also been achieved. The low percentage of illiteracy among the Maltese, the availability of compulsory education up to the age of 16 and the ability of the Maltese nation to maintain a University are all to the credit of local administrators.

On a closer examination of the situation, however, it becomes evident that growth and development have occurred due to the ability of individuals at all levels to dominate and adapt to the situation. This inherent quality can become the main source of a management approach to education which thrives on corporate strategies thus reducing organizational barriers.

It is being proposed that the human resources available and the size and historical, social and political background of the Maltese system of education favour the adoption of participative management for science education. The view is held that participative management - when applied with professionals - can improve the effectivity and efficiency of a system in which change is the only certain factor.

5.2 Proposed Management Approach

Participative management can be easily misunderstood because the degree of participation in management can vary with different types of organization using the approach. This final section of the study will attempt to answer three important questions:

a. What is Participative Management?

b. Why is Participative Management being proposed?

c. How can Participative Management be introduced?

a)

> 'Participative Management is the process of involving subordinates in the decision-making process. It stresses active involvement of the people. It uses their expertise and creativity in solving important managerial problems. It rests on the concept of *shared authority* which holds that managers share their managerial authority with their subordinates. Finally, it attempts to actually *involve* subordinates in the important decision processes of the organization, not just in tangential problems or concerns' (Anthony, 1978, pp.3-4).

While participative management does not disturb the hierarchical **structure** of an organization, it helps to alleviate the problem of subordinates having to automatically yield to hierarchical **authority.** It is based on a concept that bridges the set of polarities between centralized and decentralized control. Participative management suggests that responsibilities may be shifted in either direction through the integration of functions. Collaboration, co-operation and control-sharing help to complement individual strengths and eliminate weaknesses. Furthermore, it needs to be stressed that the concept of sharing does not mean that all functions should be shared. While

some functions such as goal-setting and policy analysis must remain within the domain of central authority, other functions such as curriculum development and adoption and skill training in educational organizations must be within the domain of the practising professionals. The method through which the integration of both domains can be achieved is that of participation in the decision-making process.

The benefits of participation can be reaped if the onus is placed both at the top of the hierarchy and at the bottom. ' [Democratic] participation may be given from above, but to survive it must be employed and practised by those below' (Bottery,1988). Other authors have developed this same point from a different perspective. They differentiate between 'genuine participation' and 'pseudo-participation' (Nias, 1972, quoted in Hughes, M. *et al*, 1985), 'restricted' and 'extended' professionalism (Hoyle, 1974, quoted in Farrugia, 1988) and 'moral rights' and 'moral duties' (White, 1983).

In other words, participative management calls for an attitude change because it concerns greater involvement and an increase in responsibility both at the individual and at the corporate level. That is, it provides a challenge for the release of individual and group potential for creative thought.

In reality, however, it is still individuals, not groups, that are the ultimate decision makers. Groups can provide assistance to

individuals in arriving at decisions. It is, therefore, important to point out that participative management also involves the understanding of human behaviour. It requires a knowledge of why people act as they do and what causes them to follow certain behaviour patterns. It implies a knowledge of interpersonal relations which involve an examination of human needs and wants, human behaviour, personality constructs, group behaviour, empathy, confrontation and counselling (Duncan, 1978; Anthony, 1978; Abdun, 1984; Darmanin, 1985). Many psychologists have addressed this issue (Maslow, 1954, quoted in Duncan, 1978; Likert, 1967; Anthony, 1978; Darmanin, 1985). Participative management leans towards the adoption of one of the most popular theories - that developed by Maslow, 1954: the Needs Hierarchy Theory. The theory states that we all have needs which exist in a priority ranking. 'The implication for managers, therefore, is to provide incentives that allow individuals to satisfy higher order needs' (Anthony 1978). Anthony goes on to explain '...that the opportunity to participate in decision-making helps the employee achieve ego satisfaction and self-actualization - the two highest needs in the hierarchy' (p.21).

To summarize, then, participative management

i. takes a middle-of-the-road view between centralization and decentralization;

ii. concerns itself with issues of professionalism and democracy; and

iii. emphasizes the difference between treating human beings as creative persons and treating them as subservient.

b) The point has already been made that the system of education in Malta is a conservative system. On further analysis, it may be added that it is conservative because of its bureaucratic structure. It is based on:

i. specialization of labour - e.g. teachers are employed to teach;

ii. standardization of work - e.g. all state secondary schools follow a common syllabus; and

iii. centralization of authority - e.g. authority for any form of innovation must come from Head Office.

Consequently, the structure is rigid and inflexible and it is difficult to adapt to change. There is an emphasis on conformity and changes that upset traditional ways of doing things are usually rejected. As pointed out by Farrugia (1985b), this phenomenon has 'historical and social roots' (p.118). It is not advisable, then, to propose a radical change of management approach because this would add to the degree of resistance to change any form of innovation is bound to produce.

However, change is inevitable and an approach which brings about an increase in the readiness to accept change must be considered. Also, the idea of the inevitability of change is not an assumption. As the

chapter on 'Trends in Science Education' (Chapter Four) revealed, changes in the method of teaching, in the content of the curriculum, in the environment and in the broader approach to the objectives of the discipline are bound to increase. If it were possible to use a line of demarcation on the time-scale of the development of science education world-wide during the last three decades, the stage reached locally would be somewhere in the middle of the second decade. The management of science education is still in the hands of a few; it is still dependent on the availability of material produced abroad; it is still concerned mainly with passes in examinations and it is still faced with the problem of lack of clear objectives.

Participative management can be used to meet the dual test of effectiveness (concern with goal accomplishment) and efficiency (concern with the cost of goal achievement - cost in terms of money, personnel, equipment, and psychological factors) (Hull & Adams, 1981, chapter 4; ASE, 1979, p.19). As an approach, it moves away from the mechanistic assumptions of structural theory toward a more humanistic approach. The Education Officer (Science) wants to see himself as a 'resource person' and teachers resent 'the failure by the authorities to allow [them] a higher degree of academic participation' (Farrugia, 1985b). Therefore, educational management must concern itself with educational ends, teachers and pupils. An attitude of collegiality finds its fulfilment in participation.

c) The introduction of participative management requires thought and time. Within the perspective of this study, it is being proposed for secondary science education only. However, by its very nature, participation will eventually involve the whole system.

Three recommendations are being made on a few assumptions which are inevitable at the introductory stage. Assuming that no radical changes take place in the hierarchical structure of the system and assuming that the laws governing education (Education Act, 1988) will remain in force for the next five years at least, it is being recommended that the following preliminary steps will be taken:

1. Some international organization, like UNESCO, should be invited to study - through a group of experts - the experiences in science education reform in Malta over the past thirty years. UNESCO has already extended its help in the organization of short courses or seminars in conjunction with the Department of Education and the University (*Modern Management Approaches and Techniques, 1983; Education in Malta: A Look to the Future, 1988*). The study should take a long-term view and arrangements will be made for the organization of a workshop/seminar when the findings of the study will be made public. Participation should start at this stage so that all the information gathered will be communicated within a specified time to policy-makers, administrators, teachers, teacher educators, advisors and parents. Therefore, it could be one of the conditions recommended to UNESCO that a wide range of participants will be involved in the study.

2. The work on a National Science Policy with clear objectives can then be started. The policy would take into account the complex nature of the scientific, educational, social and economic context of Malta. It should encourage the endogenous development of science education where the training of teachers and other science education personnel are given primary importance. Training programmes are to be designed so as to be in harmony with and supportive of the new ideas in school development. Therefore, the training course material should be prepared by local educators with expertise in collaboration with industrialists and other bodies involved in out-of-school, informal science education, such as the media.

3. The third step to be considered concerns the individual science teacher. In view of the trends in science education already discussed, science teachers are expected to be *au courant* with the needs of society and the rapid developments in science and technology. Current theories hold that students should be active participants in learning and in deploying their knowledge of science. Teachers should, as a professional body, act as leaders in science education by collaborating in the organization of in-service courses, curriculum development, review of textbooks and school administration. Commitment is an essential component of professionalism.

Participation is, therefore, being suggested at all levels of the hierarchy. Some work has already started (Education Act, 1988 sections 17, 21, 40, 44). What is needed now is a change in attitude and perception. 'Change the ideology and you change the practice' (Bottery, 1988).

APPENDIX

QUESTIONNAIRES

A. **To Education Officers (Science):**

Note: You are kindly requested to read through ALL the questions before writing your answers.

1. When were you appointed Education Officer (Science)?

2. What were your terms of reference? Are they published?

3. Are you responsible for any particular branch/level of Science?
- (please underline where applicable) -
biology / chemistry / physics / integrated science;
primary / secondary level.

4. Have you ever been involved in policy-making?
If yes, can you briefly describe some particular occasions and to what extent you were involved?

5. Do you consider yourself (as Education Officer) accountable to anybody? If yes, to whom?

6. Do you feel free to take decisions? If yes, at what level? If no, what are the constraints?

7. What do you consider to be your contribution towards the following?
a. staff deployment:
b. staff development:
c. monitoring of teachers in schools;

d. curriculum development/changes;

e. curriculum evaluation;

f. textbook choice;

g. in-service training:

h. examinations:

i. laboratory design / equipment / furniture:

8. What opportunity did you have to advise on:

a. the aims of Science Education?:

b. school differentiation (Junior Lyceums, trade schools, craft centres, etc.) ?:

c. curricular adaptation (re 'b' above) ?:

d. extra-curricular activities (e.g. fieldwork) ?:

e. work-orientated courses (i.e. leading to public examinations: e.g. civil service, bank employment, nursing, laboratory technicians, etc.)?:

9. In which areas of Science Education can you take decisions and act on them without referring to somebody else?

10. Financial considerations apart, which aspect of your present post would you

a. consider most satisfying?:

b. consider most challenging?:

c. advise your immediate superior that it needs altering, improving upon or, perhaps, strengthening?:

11. Do you find enough time to devote to your specific terms of reference? If yes, is/are there any other task/s you feel you should be involved in? If no, which task/s would you suggest should be shared responsibly by other personnel?

12. What training did you have that was related directly to your work? If none, do you now think this would have been essential? And what kind of learning experience would you consider necessary?

13. It is being considered that your contribution to the Management of Science Education in Malta (Secondary Level) is very valuable notwithstanding the difficulties encountered during the tenure of office. What suggestions would you like to make for the improvement of Science Education - from the "Manager's" point of view?

B. **To Education Officer (Educational Planning):**

Note: You are kindly requested to read through ALL the questions before writing your answers.

1. Up to April 1988, you were the Education Officer (Grade II) in charge of Educational Planning with the Department of Education in Malta.

1.1 When were you appointed to this post?

1.2 What were your terms of reference?

1.3 Were they published?

1.4 When, and on whose recommendation, was the post of Educational Planner created?

1.5 What was your involvement in policy-making?

1.6 In which areas (e.g. teacher deployment, financial matters, course options, in-service education, etc.) were you free to take decisions? What were the constraints?

1.7 To whom were you accountable?

1.8 What opportunity did you have to advise on the aims of education?

2. My main interest is the management of Science Education in Secondary Schools.

2.1 Can you briefly describe the form of liaison, if any, that took place between you, as Education Planner, and the Education Officers (Science) in implementing revised/new policies?

2.2 Once the policy was communicated to you, as Educational Planner, and to the EO's, what kind of feedback to the policy-maker was expected from you?

2.3 Which dates / innovations would you consider as 'landmarks' in the development of Science Education during your tenure of office? Why?

2.4 How do you see these developments vis-a-vis the whole school curriculum?

2.5 What procedure (e.g. consultation - with whom? and to what extent?, etc.) is usually adopted to advise on the development of a subject/school curriculum?

2.6 Who was responsible for the formulation of the objectives of a curriculum?

2.7 What was your involvement in the evaluation of curricula? If none, then who was involved?

C. **To Administrative Secretary, Malta Union of Teachers:**

Note: You are kindly requested to read through ALL the questions before writing your answers.

1. It is generally accepted that a Union of the stature of the Malta Union of Teachers constitutes a major influence on the System of Education of a country.

1.1 What are the Union's general recommendations about curriculum development in Secondary Schools?

1.2 What initiatives has it taken with regard to its views on the subject?

1.3 To what extent do you believe that teachers should be involved in this process?

1.4 What are your views on the role of Education Officers in this respect?

1.5 What form of liaison, if any, should exist between Education Officers and teachers in developing a school curriculum?

1.6 Do you agree that teachers carry the main responsibility for the implementation of revised / new policies in curriculum development? If yes, to what extent? If no, then who should carry the main responsibility?

1.7 What are the Union's views on the compulsory components of a curriculum (e.g. compulsory Physics, etc.)?

1.8 What consideration should be given to parents' views on revised / innovative curricula? What form of action has the Union taken in this respect?

1.9 To whom do you consider that teachers should be accountable?

1.10 What are your views on the monitoring of teachers in schools by Education Officers?

1.11 What action - and when - has the Union taken to express its views in this regard?

2. As you know the management of Science Education involves decisions about a number of elements such as: teacher deployment, laboratory technicians, classroom / laboratory work, fieldwork, laboratory equipment, etc.

2.1 What role do you believe teachers should play in the management of Science Education?

2.2 What are the Union's views on:

i. conditions of work inside a laboratory?:

ii. responsibility for safety in the laboratory?:

iii. the availability of laboratory technicians?:

iv. the provision of equipment / furniture?:

v. in-service training of teachers?:

2.3 What recommendations has the Union published with regard to any one or all of the above?

2.4 On which occasion/s, and by whom, was the Union consulted on matters relating to Science Education? If never, or in your opinion 'rarely', do you envisage that such a situation could change? Has the Union taken any action in this regard?

2.5 Has the Union ever requested the advice of experts (local or foreign) on matters dealing with curriculum development and in particular with Science Education? If yes, when and what action was taken?

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