

Management for Development of Defence Production by Masood Hasan[†]

The author was effectively responsible for the initial four years (1973-1977) of the setting up of Defence Production as an effective entity in the Government of Pakistan. At that time apart from purchases of Crotales, Mirages, Breguet-Atlantiques, Exocets, Tow, Daphne Submarine, Puma Helicopters... the setting up of P-711 at Taxila now known as HIT (via HRF)... The Aeronautical Complex at Kamra (Mirages), MiG 19s, later the MFI-17 (which started at Risalpur)... the manufacture of sulphuric acid, helmets...the firing of the first missile by SUPARCO and hiving off of personnel to Precision Engg (PIA)... the retrofitting of the M-47 tanks.... Getting the dead projects of Havelian (single & double base propellants), at Sanjwal (artillery ammo & fuzes), at Chhatar (getting the Trisonic wind tunnel stagnant for as long as 5 years going)....restructuring of several establishments....Pushing for exports with reference to POFs.... Construction of a jet air strip and a tank test track.... Finalizing several agreements with various governments (including China and Czechoslovakia etc) and with several private parties from Sweden, France, Italy, UK and USA.... Generating more emphasis on D&A (Development and Acquisition) rather than R&D (Research & Development) and several others such as establishing assembly/manufacture on a prime contractor basis, particularly the anti tank for the 106 mm recoilless rifle. Later as a consultant helped AWC, when it was established to make a project start on the right lines (refer to Attachment A).

I have deliberately chosen the word Management rather than Administration for the Development of Defence Production. To me the word Management is as broad as the word Technology, which I will amplify. Management, basically in the context of the topic means a process of integrating business unit resources and available infrastructure to achieve the objectives of becoming increasingly self reliant in defence materiel. My definition of technology is also simple, with reference to *man made systems*, "it is the know how to solve problems all sorts".

It is necessary to recognize that there is a fundamental difference between science and technology. Technology progresses basically in an incremental mode (the only exception I am aware of has been the introduction of the transistor). An example will illustrate what I have just said by looking at the development of the steam engine. It was started in 1680 by Huygens who tried to use the explosive nature of gun-powder to create a vacuum to move a piston. In 1690 Papin, the inventor of the pressure cooker suggested a steam engine using the vacuum to generate power. In 1698, Savery an Army engineer moved in the direction of using pressure. Since mechanical technology had not developed sufficiently his engine was used for low water lifts to pump out water from mines. In the early 18th century a plumber Newcomen made a blown up of Papin' engine, introducing an internal jet for cooling and atmospheric pressure moved the piston. He was able to achieve 4 horsepower (HP) at much less cost than having 4 living horses to do the work (refer to Attachment B).

[†] An unpublished paper of 2001 (meant for a Seminar that did not take place)

In 1767 Smeaton an instrument maker increased the HP from 4 to about 12. However, there was no new invention on his part. What he did was to improve the materials of construction by boring better cylinders. In 1775, Watt, also an instrument maker, added a separate condenser and a governor for control, the result was 24 HP. Later, the introduction of a 2 stroke engine upped the power to 36 HP. From 1800 to 1830 machines with more than one cylinder were introduced ultimately raising the HP to about 100. You may observe that this was an incrementally cumulative process lasting over a century to achieve 100 HP. More importantly, it is significant to observe that improvements could only be made based on extremely intimate ground level knowledge of the physical details of the engine, which is the level at which success or failure is always achieved ie the operative level, in no uncertain terms. This applies to most human endeavour. We need to accept that the devil lies in the detail which is consistent with the technological approach. The other aspect is the vast outreach of technology. The Scientist deals with nature *within* the restricted walls of a laboratory and a new theory may throw out all the old overnight, generating a quantum leap. The technologist deals with the wants of the people which includes behavioural facets. Technology also requires both an understanding of the physical laws as well as ensuring cash flows are positive, of capital investment, of depreciation, of setting up and taking down costs, of productivity and standardization. These are all parts of the total technological picture. This adds up to a lot of interacting complexities but hardly any quantum jumps.

During my sojourn with the Ministry of Defence Production with special reference to projects I dealt with some that

1. were on-going
2. others that had first started and in hibernation
3. those that had or were about to be closed down and
4. the new.

Since there was no relevant project expertise in the Ministry I virtually acted as my own Project Director, while training personnel in the Ministry to measure up and to shoulder their responsibilities. The middle 70s was a very busy, active and interesting time in a build up in several directions. (refer to Attachment A).

Nature of Development

While developing components for various equipment/machinery it has to be borne in mind that budget estimates, in both money and time, are usually exceeded. Further, the development effort may result in a total write-off, but with spin-off benefits. Non-recognition of these factors on account of the existing highly bureaucratic approach ensured very little indigenization took place. We made a beginning with a simple item of the T-59 tank: the radiator cap. It had several components. This start up was made in three garages situated behind the Joint Chief's Headquarters. Progressively more and more complex items were developed, of basically a homologization process. We then moved on to the clutch plate obtaining metallurgical assistance from the Chinese and later had a small air compressor developed successfully by a party in Multan to help in

tank start up. The induction of commercial discipline made it possible to move in a reasonably secure fashion, this means it was placed on top of military discipline – an unbeatable combination. So over a period of several years 3982 parts were ultimately, developed rather homologized, in the private sector according to plan, for the T-59 tank. About 4000 were manufactured in the Chinese aided factory, making a total of about 80% deletion by number. I do not believe this has been achieved in the private sector to date! We need to study such successes and then disseminate the results in the form of case studies indicating the overall gains made by the Vendors. This is ultimately a gain to Pakistan because of increased employment opportunities and taxes paid. It is unfortunate no one has moved in this direction. Publicising how this achievement came about will encourage others to move appropriately. I am aware the T-59 tank may be obsolete, but certainly not the processes for ensuring increasing measures of self reliance. I felt it was a routine matter to ensure these achievements because of my experience in the private process industry (both abroad and in Pakistan).

Structure & Operations

It is interesting to note that the traditional technologies including Railway Carriages, Cars and All Engineering continue with the well known pyramid structure (refer to Attachment D). Whereas intermediate technologies of machine tools and scientific instruments exhibited a pinched or blown-up-in-the-middle pyramid. However, in aerospace, electronic capital goods and computers the pyramid is literally turned upside down! This is also the experience of the author who had visited a factory involved in manufacturing RPVs (remotely piloted vehicles) in Europe. Out of 303 employees in a factory in Trieste only 73 were the equivalent of semi/unskilled workers. The rest were professionals! When addressing ourselves to technology it should be brought home to us that there is no such thing as a “standard” organization structure to obtain results. In Pakistan this is important because the public sector has a habit of ensuring a small organization is structured on the same lines as a behemoth. Nearer home it is of interest to look at how our governmental processes function. The three essentials are the

- Human Resources
- Decision Making (Organizations/Structure) and the
- Operating Systems & Procedures.(the Organics)

Because we have never considered it necessary to relate the requirements of the transitional phase from a law and order cum revenue oriented economy (inherited in 1947) to that of a value added, developmental or a technologically oriented economy: the necessary inputs to generate adequate/correct responses from the government are missing. Amongst others, an appreciation of the Qualitative Shift (QS) can help to mould thinking on the right lines. Briefly, the QS postulates as organizations grow in size for whatever reason, that old methods of solving problems similar to those as in the past do not deliver the goods if only on account of increased size and size alone.

One of the results of the lack of appreciation of advances made in the world around us and the increasing necessity to remain competitive---not in primary goods but those with

value added has led to horizontal stratification in the common threads of administrative effort to personnel occupying roughly the same level in an hierarchy (refer to Attachment E-1). This provides a visual explanation of the ease with which policy can and is changed as against the almost impossible task of altering a lowly procedure. This indicates the difficulty in moving, not so easily, from Levels A to D but with very much more difficulty (on account of one way filters that impede accurate knowledge of what is going on at the lowest levels) to those at the higher ie from Levels D to A. This is another way of saying that feedback information for the higher levels is easy to present in a misleading fashion. Functional hierarchies could concern accounts, finance, police, engineering, customs or excise, here upward/downward communication is (functionally) quick (refer to Diagram E2). Superimposing E1 on E2 we get E3 which pictorializes the "island" or the "one and a half brick mosque", the way that government departments usually function. I made sure such situations were minimized. Unless those concerned with enunciating a technology policy are prepared to consider the factors brought, and there are many others, it will not be possible to produce a coherent policy ie one that is implementable. Technologists it appears have yet to learn the language of administration for they do not appear to be articulate on this topic.

Strategy and Transitional Problems

The quicker one wishes to move the more important strategy becomes. When one wants to move from an existing Point X to Point Y in the future there are requirements which any strategy must consider:

- There must be an accurate definition of current status (Point X)
- Defining the future Point Y, there is little difficulty in defining it. The further away in the future it is, the easier it becomes!
- The transitional phase problems in moving from Point X to Y so as to work out a practicable methodology and time phasing of arriving at Point Y. This is usually ignored, resulting in failures, e.g the Nishan jeep project.

Visualizing the transitional problems calls both for experience and breadth of vision. Thereafter, to be able to work out ways and means to take care of them calls for courage and innovation, because no precedent ie evidence is available. All development means change which must create transitional states. Leadership is essential, for no change means no leadership.

I must point out growth is not necessarily development. The garbage dump near my house over the years has increased in size, but that's not development! Development also means working within **existing** resources but more productively ie managing change, ie increasing both capability and competence. Disruptions need to be minimized to keep the system in a manageable condition. The interrelationships or the cross walks need to be exposed so that a planned visual of the mosaic of activities to be undertaken is always kept in focus. This is what mapping a system means, and remember all maps (Standard Operating Procedures included) need to be kept current.

With the objectives known a sympathetic organization structure (mechanistic) has to be developed as force (orders) can only be transferred through a structure which permit the organics or the operating systems and procedures to function at the ground/tactical level ie where the "productive" work well and truly takes place. The QS also affects the recruitment, in-house training and career development of human resources in many ways.

Re-appropriation

A "problem" faced by many departments is of spending large sums of money, which would otherwise lapse, in the months of May and June. This, of course, leads to wastage of resources even though all procedures are well and truly followed. Since I was familiar with PPBS (Program Performance & Budgeting System) introduced many years ago in the US Department of Defence, which ensured diverting funds from a tardy project to a quicker moving one was done, subject to achieving certain milestones. When there are many projects some will move very quickly, some very slowly and the rest in an average fashion. If graphed the usual bell shaped curve emerges. Using the PPBS approach, which I could only do at an approximately (better, the approximately correct, decision at the right time, than the absolutely correct at the wrong) made it possible, to divert funds. One result, amongst others, was to set up a Tank Test Track (not originally envisaged) without additional expense ie free of charge. Of course to make PPBS work properly calls for a reliable feed back system. To be remembered is that a wrestler may be good weight lifter, but his designing capability for a crane would be highly suspect! Similarly, a good decision maker may not be capable of designing a good management information system. Administratively a decision is but a moment in the process of work flow.... the system organics, through procedures is the process.

Whatever I may have achieved was directly dependent on the application of the concepts brought out. I would be remiss if I did not refer to at least one development in Information Technology. I would advise Senior Managers to familiarize themselves with Data Mining as it will bring home in no uncertain terms the need for setting up data bases, and more importantly their continued maintenance so as to use smart programs to interrogate masses of data and bring out correlations or exceptions which help further questioning, the important point is that this is done in a few seconds and not in weeks, all this helping to plan better.

This paper brings out the following:

1. The incremental nature of technology (that this is the basic difference from science), which establishes that the devil always resides in the detail ie the level at which success or failure of a policy mission/strategy is determined.
2. The need to understand the nature of development, that it is not the same as simple growth. That development may also result in failures ie write off of the effort.
3. That commercial discipline is the basis for development on a sustainable basis, combined by subordinating military discipline to it is an unbeatable combination.
4. That the three aspects of man made systems:

- Human Resources
 - Structure
 - Operating Systems and procedures
- are interrelated and that technology should dictate the structure, this helps in creating sympathetic organics (SOPs) including information flows and training requirements.
5. There is a need to understand the approach to transitional phase problems as this is basic to the management of change. Lack of appreciation of this leads to reinforcing the status quo. Because of failures, the burnt child fears the fire.
 6. When there are a large number of ongoing activities/projects, that re-appropriation of funds for better resources utilization is practicable using PPBS. This is a cost effective approach.

SOME PROJECTS/ACTIVITIES

- CROTALES
- MIRAGES
- BREGUET – ATLANTIQUES
- EXOCETS
- TOW
- SUBMARINE (DAPHNE)
- PUMA HELOS
- P-711/HRF/HIT (T59 & HOMOLOGIZATION OF 3982 PARTS LOCALLY)
- PAKISTAN AERONAUTICAL COMPLEX
 - MIG 19s (721)
 - MIRAGE (741)
 - MFI-17 (751)
- SULPHURIC ACID
- HELMETS
- RETROFITTING M-47s (Masjid-e-Sulaiman)
- HAVELIAN (S & DB PROPELLENTS)
- SANJWAL (HEAVY /MED ARTY AMMO AND FUZES)
- CHHATAR (TRISONIC WIND TUNNEL)
- FIRING FIRST MISSILE (SUPARCO)
- RESTRUCTURING (DSO-LATER DESTO, ARDE)
- PUSHING POFs INTO EXPORTS
- MANUFACTURE & EXPORT OF 106 MM RR (PRIME CONTRACTOR PROBLEMS)
- AGREEMENT WITH FOREIGN GOVTS (CZECH, CHINA, FRANCE)
- AGREEMENTS WITH PRIVATE PARTIES (SWEDEN, FRANCE, ITALY, UK, USA....)
- NISHAN JEEP (CLOSURE)
- WHITBY FRIGATES (CLOSURE)

STEAM ENGINE DEVELOPMENT

1680	HUYGENS	-	Concept	
1690	PAPIN	-	Pressure Cooker/Vacuum	
		-	Low Lift Water Pump	
1698	SAVERY	-	Internal Jet	
1720	NEWCOMEN	-	Better Boring	4 HP (Plumber)
1767	SMEATON	-		12 HP (Instrument Maker)
1775	WATT	-	Condenser/Governor	36 HP (Instrument Maker)
1800]	CYLINDERS			
]	NUMBERS WERE			Upto 100 HP
1830]	INCREASED			

It took about 100 years from a 4 HP engine to that of 100 HP

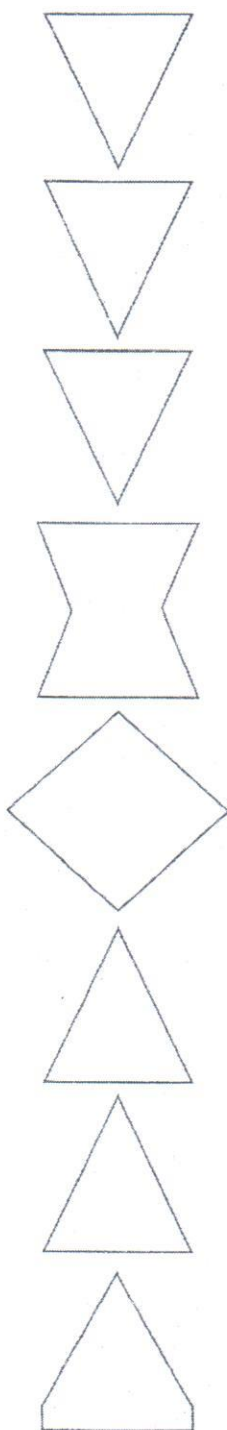
SOME TIME HORIZONS

FACILITIES AVAILABLE	PRODUCTION
<ul style="list-style-type: none"> BUILDING PLANT/M-C PERSONNEL, TECHNOLOGY PURCHASED 	1 - 2 YEARS
<ul style="list-style-type: none"> (COPY) TECHNOLOGY BUILDING PLANT/M-C PERSONNEL 	2 - 3 YEARS
<ul style="list-style-type: none"> TECHNOLOGY KNOWN FACILITIES TO BE CREATED 	3 - 6 YEARS
<ul style="list-style-type: none"> NEW PRODUCT TO BE DEVELOPED, FOLLOWED BY VOLUME PRODUCTION (D&A) 	5 - 7 YEARS
<ul style="list-style-type: none"> R&D - NEW PRODUCT TO BE DEVELOPED, FOLLOWED BY VOLUME PRODUCTION (D&A) 	7 + YEARS
<ul style="list-style-type: none"> NEW QUALITY RICE 	15 YEARS

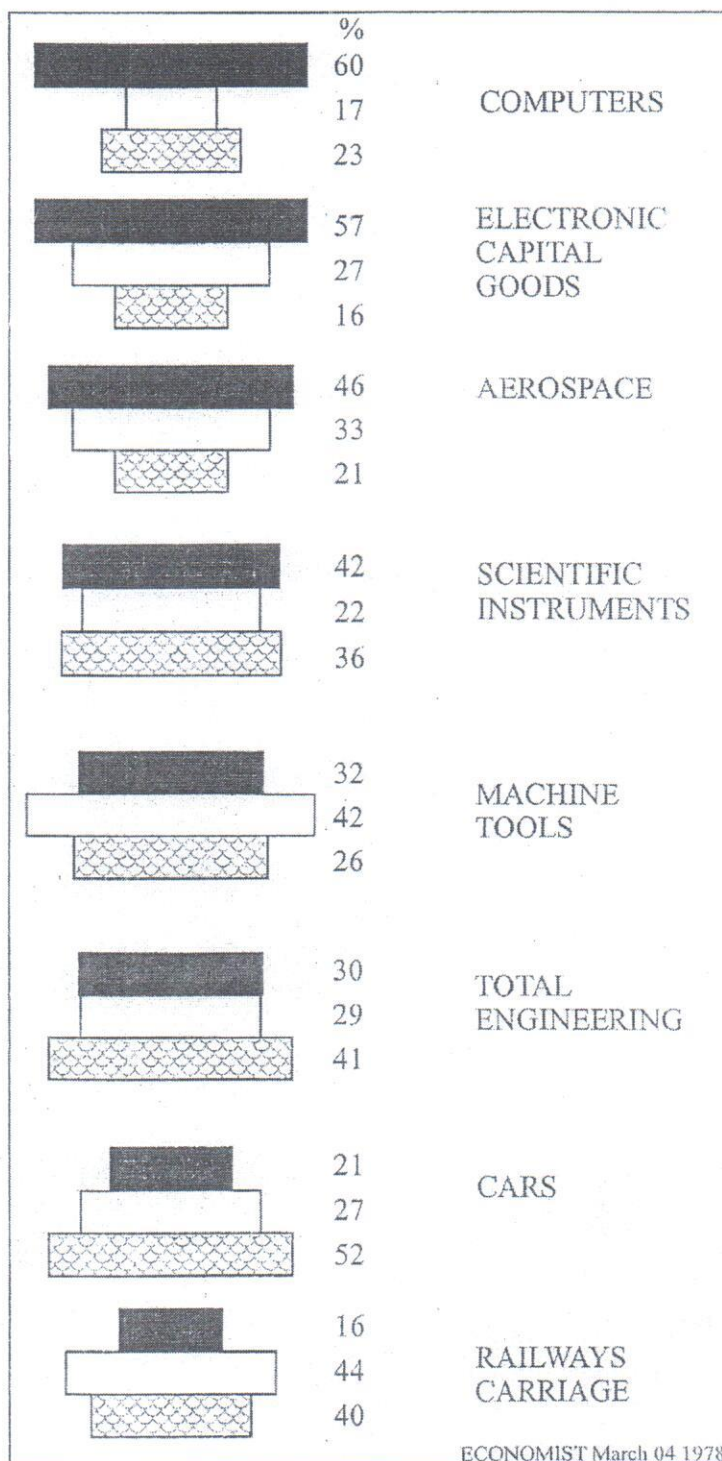
(R&D = Research & Development)

(D&A = Development & Acquisition)

STRUCTURE



SURVEY FINDINGS



KEY:

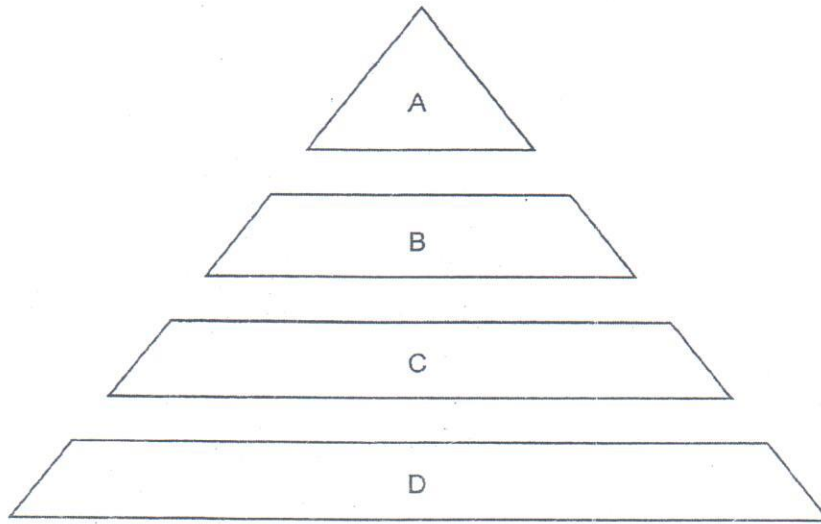
MNGRL/ADMIN/CLERICAL

FOREMEN/SKILLED OPS

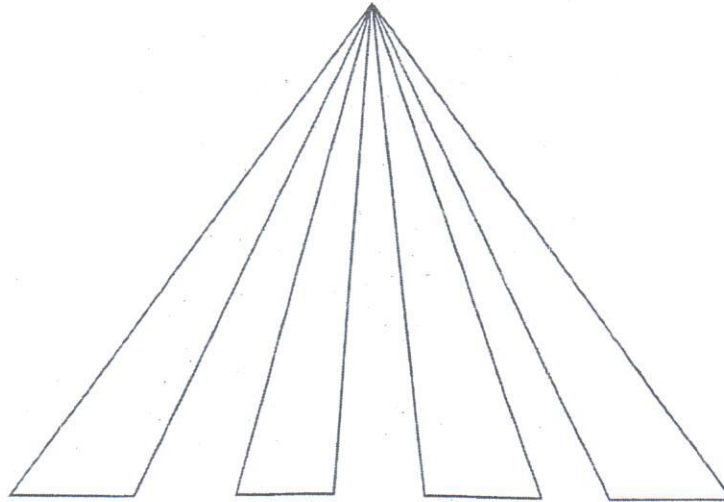
SEMI/UNSKILLED



E-1



E-2



E-3

