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CAPTECH
MANUAL

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

CAPTECH

**(CAPITAL INVESTMENT EVALUATION FOR TECHNOLOGY UPGRADATION
CAPACITY BUILDING FOR TECHNOLOGY ABSORPTION)**

MANUAL

CONTAINING

LOGIC, METHODOLOGY & STEPS
USER ENTREPRENEUR GUIDE
ADMINISTRATOR & ASSESSOR GUIDE

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PART II METHODOLOGY TO USER INDUSTRIES

PART III ASSESSORS' GUIDE

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Several rounds of discussions with Dr. Y.S. Rajan of CII and Mr. S.K. Bijlani of Magnus consultants contributed to significant additions to the methodology. The Technology group of CII under the leadership of Dr. Y.S. Rajan has taken the initiative to promote the pilot audits and has given vital field support at the crucial time.

The team consisting of Prof. J. Govardhan, National Expert TBIIP, Mr. V. Anbu, Dy. Director CII, and Mr. Sushant Pal of SIDBI made the initial audits.

The methodology was presented and peer defended at the International Workshop on Technology Management organised by UNIDO - TBIIP at New Delhi in December 1999 . Over a hundred participants from industry, chambers of commerce / associations, academia, consulting organizations, scientific and management bodies participated and contributed to the methodology.

International Experts namely Prof. Chiesa of International Centre for Science & High Technology Trieste ,Italy, Dr. Ramanathan of University of Western Sydney, Australia and Dr. Javier Rodriguez of CEGESTI, Costa Rica made valuable contributions to the Workshop.

M/s Micromatic Grinding Technologies Ltd. Ghaziabad, M/s Shivani Locks Ltd, Faridabad, M/s SSP Ltd, Faridabad, M/s Horizon Industrial Products, New Delhi, M/s Crane-bell International, Ghaziabad, and M/s AVS Brake Linings Ltd, Gurgaon, gave valuable support by agreeing to undergo pilot audits at their respective enterprises.

The methodology was also presented to a select group at UNIDO head quarters in Vienna to solicit the opinion and suggestions from this elite group. This group gave appreciation, support, encouragement and a wide-ranging set of guidelines for incorporation and adaptation of the methodology.

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PREAMBLE

The SME sector contributes significantly to Economy, Employment and Environment in the developing countries. A need for a Universally applicable scientific tool for Technology Needs Assessment for SME's has been bogging UNIDO for quite some time. Such a methodology is needed to facilitate assessment of the technology strength and hence strengthening of the SME sector.

The potential and importance of the small and medium enterprises (SME) sector as a backbone for economy is often understated in the industrialisation process. The SME sector is very vital for developing countries and economies in transition.

**In India 95% of the industrial units are small-scale industries (SSI) which contribute to 40% of manufacturing outputs, providing employment to 17 million people. Also 35% of the exports originate from the SSI sector. It is believed that over 3 million industries fall into this category.

*China's SMEs account for 62% of its industrial output value and generates 47% industrial tax revenues. In the European Union (EU) countries, SMEs account for over 50% of establishments, national product and employment. In France, SMEs account for 80% of domestic firms having investments abroad; while in Canada the figure is 58% and in USA it is 49%.

Small and medium enterprises nurtured in the protected environment in developing countries will have to be exposed to the culture of competition. To survive and sustain in such a culture they need to identify Technology Gaps within their operations. Also they will have to learn to be competitive since they will be exposed to scientific competition arising out of technology and aggressive sale strategies. They will find it difficult to sustain in open market environments unless they gear-up to face the situation scientifically. The SMEs in developing and transition economies are traditionally weak in technology and they lack in their capacity to attract investment. They tend to attach a low priority to technology because of their inability to find associated investment. The UNIDO's role towards industry in these circumstances has been one of capacity building for competitiveness through integrated packages of services at policy, institutional and enterprise levels.

Any attempt to catch up with technology requires basic inherent competence. It is a misconception that, acquisition of new technology is a panacea for all the problems of SME'S and that it can be done by all and sundry with only the power of finance. Acquiring technology and applying it to get the advantage of competition and sustained profits would require basic capacity to assimilate the technology and manoeuvre & control results with it; otherwise, new technology, obviously, sophisticated technology, could be like catching the tiger by the tail.

**Annual Report 1998-99, Ministry of Industry, Government of India
*Chengxin An – Vice Chairman, China Chamber of International Commerce,
Role of non-governmental Organisations in strengthening SME sector
XI International Conference on SME's – March 1999, Mumbai.

Technology Management leading to innovation and generation of Core competencies will be what is needed. Due to technology changes over time, the technology management has to be dynamic to the technology order and continuous across time domains. In order to manage technology efficiently, a systematic approach to capacity building is being taken by UNIDO. Technology Management abilities implies operating efficiently through a cycle of activities consisting of

- Technology Assessment
- Objective understanding of Gaps
- Managerial Strategy for Technology upgradation through Investment
- Technology Upgradation

The CAPTECH manual is UNIDO's tool for accomplishing the above functions scientifically. This manual has been developed for the application of the UNIDO CAPTECH Technology Audit tool. This tool has been developed after an International workshop held at New Delhi, India in which different methodologies of Technology needs assessment were presented together to a forum of Technocrats, Consultants, Practitioners, SME's, Network partners and Focal Point members of UNIDO-TBIIP at India, Industry institutions, and Academia. The workshop deliberated in detail the workability and effectiveness of the different methodologies. Towards the conclusion the participants were constituted into 4 groups, each group with diverse representations, ranging across all the above types of participants. Each of the groups also had one expert within it. The groups further worked on the shortcomings of existing methodologies and proposed what should be the ideal content of a comprehensive methodology. Mr. Subhash Bijlani integrated all the recommendations and the consolidated proposals were given to the UNIDO TBIIP. The UNIDO administration at Vienna, also critically assessed the proceedings. Mr. Antonio Pinto Rodrigues, Acting Director, Investment & Technology Promotion Branch, brought back the focus on Investment. Mr J. M. de Caldas Lima, Senior Industrial Development Officer stressed the need for wider dissemination and quick action for developing a manual. Mr. Ouseph Padickakudi Programme Manager, and Mr. Rajiv Bhatnagar, National Project Leader, entrusted the responsibility for the development to Prof. J. Govardhan, National Expert, UNIDO-TBIIP to speedily work towards it and generate the necessary manuals. All the above cited persons have added the necessary wisdom and experience in the effort to culminate in the form of this manual.

CAPTECH is the Acronym for

"CAPITAL INVESTMENT EVALUATION FOR TECHNOLOGY UPGRADATION"

And also for

"CAPACITY BUILDING FOR TECHNOLOGY ABSORPTION

"Capacity Building" being the prime focus of UNIDO operations is the perspective for this manual. The integrated methodology has been developed with large scale assistance consultation from a number of sources and persons."

PARTS OF THE MANUAL

To address the needs of different segments of persons, who will be using the manual, the manual has been developed in different parts. Each of the parts has been designed keeping in view the exacting requirements of the particular set of persons to whom the part is relevant. However, each of the parts is comprehensive within it. Between the different parts however, a certain amount of repetition is unavoidable since the intention of the author is to make each part self-sufficient. To restate the intention of the parts, care is taken to ensure that persons who will be using the manual will not get information which is, unnecessary and out of context to them.

The manual is developed in four parts as follows:

PART I	LOGIC OF THE METHODOLOGY, AND STEPS
PART II	APPRAISAL OF METHODOLOGY FOR USER INDUSTRIES
PART III	ASSESSORS' GUIDE
PART IV	MANUAL FOR TRAINING

Part I **Logic of the methodology and steps,** is basically addressing the needs of the persons who want to examine the veracity of the methodology and its technical appropriateness. It is designed to satisfy the cross-examination of scientific base and would be of interest to Academia. This part would also outline the premises and the foundations upon which the methodology is built.

Part II **Appraisal of methodology for user industries,** is designed to explain to the entrepreneur about how it can be of use to him in Technology needs assessment and how it would rationally lead to the decisions on Investment and Technology upgradation. It would also explain to the entrepreneur about what the assessors and administrators would do to evaluate his enterprise.

Part III **Assessors' Guide,** is intended to address the needs of the assessors in terms of how they should guarantee objective results to the enterprise. It also assists the assessors in deciding on critical issues of how to examine the operations and what exactly they should use as criteria of assessment, how are the ratings arrived at etc. This will also have a section which will explain what they should do in terms of frequently asked questions.

Part IV **Manual For Training** provides information about the expected attributes of assessors in terms of their qualifications and the ingredients which should be contained in the training programme. It would also contain a standard trainee course kit and the trainer's kit explaining how to train. This has been developed keeping in mind the fact that the expertise needed to apply the CAPTECH audit on enterprises is not widely available. Also, the reality is that the magnitude of the task of taking the methodology across a vast country like India, wherein, as on date about 3 million SME's are to be serviced with the methodology, is overwhelming. There is a need to create competent assessors in large numbers to disseminate and provide the methodology for application widely. This is the context of the development of Part IV as a Manual for Training.

These parts are separately available depending on the client.

Not-withstanding the technical validity of the tool, the following set of assumptions form the framework of the environment for which this tool has been designed:

1. *The purpose of the Technology Audit through CAPTECH is to increase the competitiveness of operations with respect to current technology and give strategic vision for technology upgradation through investment to the entrepreneur.*

2. *If an enterprise cannot operate current technology to competitive advantage it will find it more difficult to operate advanced technologies to competitive advantage.*

3. *Entrepreneurs in developing countries need to develop core competency culture before venturing into international partnerships for survival*

4. *SME's in developing countries badly require identification of areas in which core competency can be developed through innovation.*

5. *The CAPTECH administration has to be a continuous process like ISO quality certifications to facilitate proper vision of the Top management of the company and it needs to be applied at least once in 2 years. It is hoped that, the Governmental agencies in the respective countries would take the initiative to support such administration and would work with UNIDO for the cause of Industrial Development and enrichment of the Economy, and employment in the respective nations.*

EXECUTIVE SUMMARY

The rapid changes in technology in the current era are responsible for creating multi-prong variations in the market place in respect of competitive advantages demands, ruling prices etc. These drastic alterations are due to the technology variations found in different products.

Technology therefore plays a very vital role in deciding the sustainability of the business operations of an enterprise and leveraging it in the market place for competition.

Technology Management is the task of managing technologies in a world affected by dynamic changes and continuous outdating of the technologies found in previous products.

In such a situation coping with technology is a major problem for enterprises. The technology needs assessment methodology is engineered in this context.

The methodology begins by identifying components of Technology in any given activity. This is done independent of the product and hence the sector to maintain universality of the validity and applicability of the methodology.

Technology is split into 8 ingredients in any operation / activity. These are:

1. Basic Operational Infrastructure
2. Product Technology
3. Process Technology
4. Skill and Knowledge base
5. Systems & Practices
6. Information Support
7. Logistics & Optimisation Level, and,
8. Managerial Approach

Rational scales are developed to facilitate ranking of each of these Parameters called as Technology Parameters.

To assess the Technology needs of a company, the strength in the operations in terms of the rankings of each of the above parameters are assessed at vital stages identified within the company. A process of interaction with executives is first undertaken to facilitate technical appraisal about the specifics of the product to the assessors. The company should also furnish the competitive factors appropriate to them. The assessors then study the operations at the floor in action to assess the reality in terms of the Technology parameters.

The assessment leads to the rankings arranged in the form of a SWOT matrix. The strength data so obtained is analysed and the weaknesses are listed in order to generate a prioritised action plan to improve technology strengths.

The CAPTECH report provides the summary of the above analysis along with a Specific set of recommendations is provided in three classifications. These classifications are known as Straight-Forward Options, Reformation options, and Strategic Investment and Technology upgradation options.

CAPTECH MANUAL PART I

BROAD LOGIC OF THE METHODOLOGY AND STEPS

THE UNIDO CAPTECH MANUAL

PART I BROAD LOGIC OF THE METHODOLOGY, AND STEPS

PREAMBLE TO TECHNOLOGY NEEDS ASSESSMENT

Developing and least developed countries across the world have a necessity to cope with technology in order to strengthen their economies consistent with the world order. This is the only way to face a world in which economic and trade barriers are to be removed. Catching up with technology is still a myth for these countries due to their own intrinsic financial weaknesses and inability to recognise Technology and breed it internally. It would be unwise for these countries to develop technologies going through the grueling stages which were already trekked by the developed countries. It is therefore wiser to seek international partnerships to achieve technological advancement. Partnership is a delicate understanding between two sets of people. In order to sustain it, each one should feel the concerns of the other and they should have a complementary role wherein, each one finds that the other has a value addition for him. In the context of Industrial operations, examples of successful partnerships are the following combinations:

STRONG FINANCE	STRONG COMPETENCE
HIGH CAPACITY	MARKET ACCESS
TECHNOLOGY	CORE COMPETENCY
PLANT & MACHINERY	COMPETITIVENESS
INFRASTRUCTURE	LABOUR AVAILABILITY

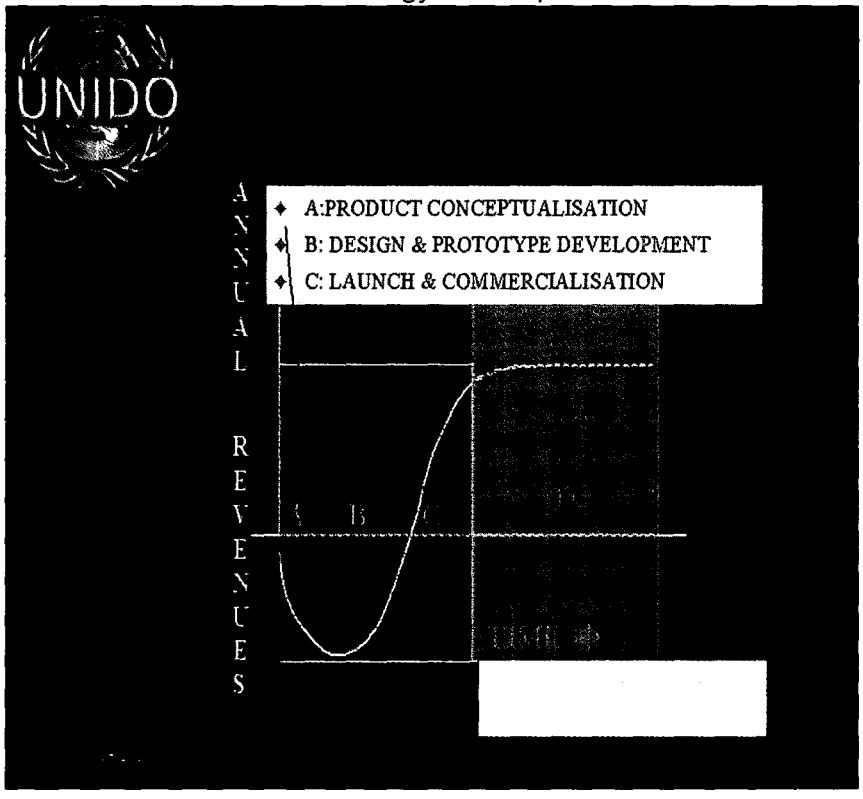
These partnerships clearly depend on the strength of enterprises.

Technology strength a forerunner for international partnerships

Clearly, developing countries and LDC's will find it difficult to be on the left-hand side status above namely, Strong finance, High Capacity, Strong Technology, Good Plant, and Machinery, and sophisticated infrastructure. However, the status on the right hand side elements, namely, strong competence, Market access, Core competency, Competitiveness, and labour availability could become their strengths. These strengths can first be achieved on the basis of existing technologies. SME's however need assistance in prioritising their investment options for technology upgradation since they are incapable generating the resources for large scale enterprise revamping. The Captech Technology audit is customised to assess and generate such priorities objectively.

TECHNOLOGY LIFE CYCLE VS PRODUCT LIFE CYCLE

The entrepreneurs in developing countries represent a community, which is eager to get returns from their investments. Therefore, they would prefer to get revenues out of their investment as soon as possible. The eagerness to generate revenues weighs heavily against perfecting technology before product launch and therefore imperfections creep into the system. Figure 1 shows the Typical Technology life cycle. The Technology Life cycle has four distinct zones. They are,



A: Product Conceptualisation

B: Design and Prototype Development

C: Launch and Commercialisation

D: Sustained marketing and business operations

A product is available for launching at the end of stage B. Therefore, very often stages C and D are referred to as Product life cycle in contrast with Technology life cycle. An entrepreneur who proposes to take on manufacturing on the basis of a project developed through A and B, would buy the technologies developed through A and B to be commercialised and is interested in commercially exploiting it. Therefore he would not want to waste much time effort and resources to "Develop the Product on commercial lines" through application of resources in stage C. However, the operational economics of the product, from the business point of view, would very heavily depend on the "Original Work" done in Phase C. Stage C activities are also sensitive to technology changes which are, today a continuous process.

LIFE CYCLE CONCEPT OF PRODUCT DEVELOPMENT

Product Development is the activity of converting a technically viable product into a revenue earning proposition through commercially exploiting the technology for industrial operations for making profitable business.

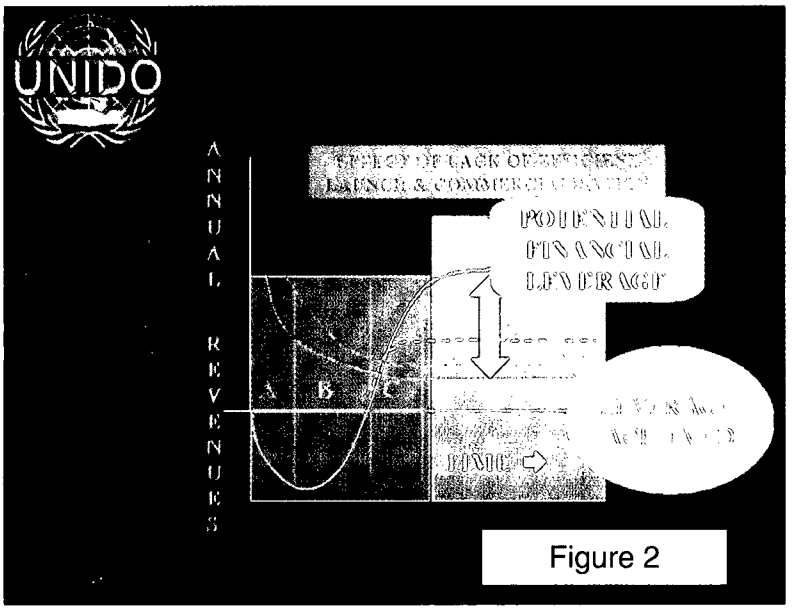


Figure 2

On many occasions this effort involves much more than the designer's concepts of product performance. Very often it is also a trial and error game unless it is skillfully handled through scientific applied R & D. SME's very rarely can afford to look into these issues. The result is the loss of financial leverages and competitive advantages as shown in figure 2. The loss of leverages may be due to multiplicity of factors involved in the inputs into the manufacturing / Service system. Typically, the inputs into any business process, either a manufacture-market type or service-market type situation has the so called 5 M's namely, Materials, Machinery, Men, Money and Management. There are any number of ways in which this can be stated and hence we have the concept of 8 M's etc. Hasty actions during the launch and commercialisation phase could lead to errors in any or all of these inputs. These errors can be conceptualised as Technology Gaps or "**Technology Needs**." It is in this context that a "**Technology Needs Assessment**" is needed to retrieve the lost advantage of financial leverage and corresponding competitive advantage. Technology needs or gaps may also arise due to the science changes in related fields over time. Time can make what is right today as wrong tomorrow. This is due to the rapid changes in the world in the form of inventions, innovations, adaptations etc. It can also be due to developments in "**Engineering**". In this treatise, very deliberately engineering and Technology are not used interchangeably. Engineering can lead to a Technology but not vice versa.

COMMERCIALISING TECHNOLOGY FOR COMPETITION

The loss of financial leverages could be avoided by full-scale deliberate and intelligent effort in Launch and Commercialisation. Such effort would require

- Assessing competitiveness in the present technology and hence Technology needs. (Administration of Technology audit).
- Assessing present technologies and comparing it with the state of art (Bench marking).
- drawing upon experiences from others (Best Practices)

- applying original intelligence to develop core competency (Innovation)

This CAPTECH tool is designed to accomplish all the above in Phases.

APPROACH TO TECHNOLOGY NEEDS ASSESSMENT

The Technology Needs Assessment of a company is done by a Technology Audit. The Technology Audit is done using the UNIDO CAPTECH tool, ideally by a team of 3 **assessors** with one acting as a **Administrator**. In order to facilitate the technology Audit, the company is stratified with respect to the different stages of manufacture / operations. At each stage, the parameters of technology with respect to the identified competitive factors are assessed. The basic purpose of the Technology needs assessment by using the CAPTECH tool, is to trigger actions of technology acquisition, and to guide in investment decisions to enable the sustenance and survival of a company in an open economy. This is done with respect to competitive factors appropriate for the given company. It is therefore necessary to begin with the competitive factors that affect the company.

COMPETITIVE FACTORS

*" Any factor which forms the criteria for a customer to affect his purchase decision is called **Competitive Factor**".*

Clearly, competitive factors are market based and are external to the company. The CAPTECH tool can be administered once the appropriate competitive factors for the company are chosen. This is to be chosen from among a potential list of competitive factors.

The following is a representative set of competitive factors:

1. Quality
2. Price
3. Delivery
4. After Sales Service
5. Flexibility
6. Aesthetics and Ergonomics
7. Environmental Considerations

The enterprise being audited can choose any three competitive factors from the above list depending on appropriateness as per customer feed back. Wherever required, to facilitate the entrepreneur to select these factors a methodology is proposed by this manual (refer appendix 1).

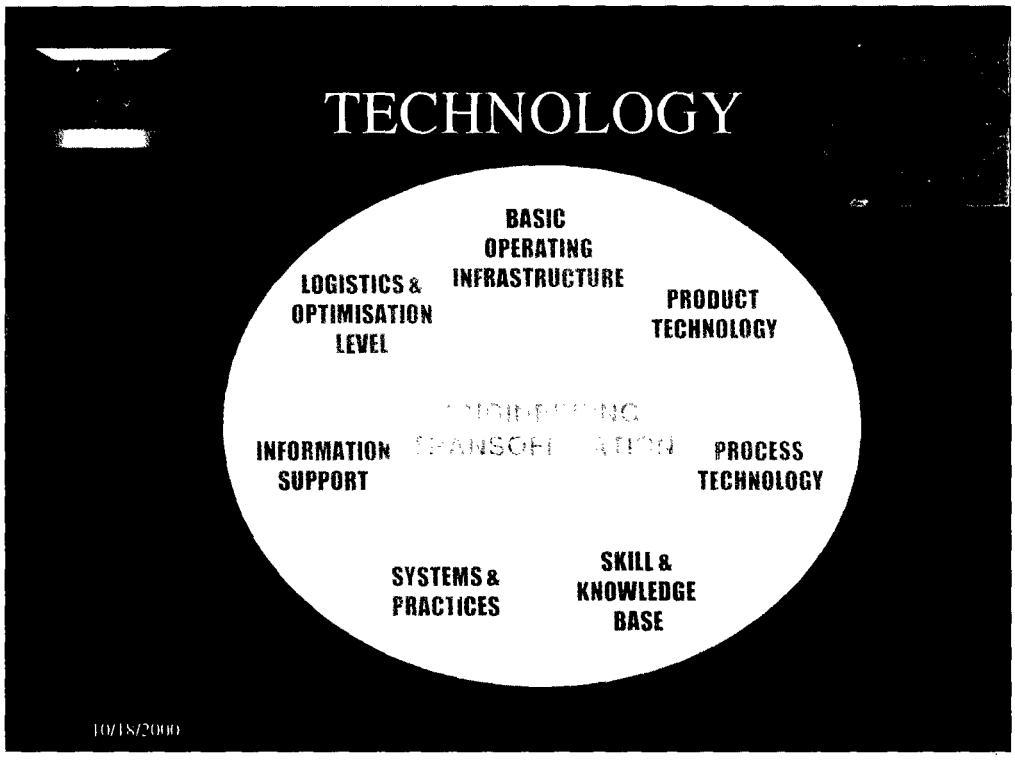
TECHNOLOGY DEFINED

Technology is a liberally used word to mean many things in many contexts. Very rarely it is pinned down to the grass root level to meddle with it. Therefore it is very necessary to define technology before working on Technology Audit. For purposes of this manual,

*"Technology includes all the inputs required to convert an Engineering idea into a product which can fetch revenues from business; therefore Technology is a combination of **Basic operational infrastructure**, Product Engineering described as **Product Technology** which is responsible for the market demand, Process control elements described as **Process Technology** which accounts for right delivery in large proportions, the human inputs of **skill and knowledge base** required for operation, the **information support** to make the conversion efficient, the **systems and practices** which make the conversion process fool proof, the **Logistics & Optimisation level** which provide for productivity, ease and efficiency of operation, and the wisdom of **managerial Approach** which will ensure sustenance of business".*

Clearly, the **parameters** of technology are:

Basic Operational Infrastructure
Product Technology
Process Technology
Skill and Knowledge base
Systems & Practices
Information Support
Logistics & Optimisation Level
Managerial Approach.



Competitiveness is provided for by virtue of the characteristics in each of the above. **Technology assessment** is therefore the examination of the degree of strength in each of the above **Technology Parameters**. There exists a **Technology Need** whenever there is a gap in any of the above parameters in an enterprise. The elements included in each of the parameters are explained here below:

Basic Operational Infrastructure

This refers to the infrastructure of the company with which the operations are carried out. It includes Plant & Machinery, and such other operational assets excluding Land & Buildings (Assets exclusive of land & Building). By virtue of the degree of investment in these, the company will have to choose the Technology, which can stand on it or fit into it. This Basic operational infrastructure has a definite bearing on the kind of technology it can take-on and hence it directly contributes to the magnitude of competitive strength. Its levels could be defined in terms of monetary values. It is important to keep in mind that for a given product and operating turnover, the massiveness of the infrastructure may not be always meaning the competitive strength of the company. On the other hand, A massive infrastructure for a low turnover may be responsible for its lack of competitiveness.

With respect to a given competitive factor the Basic operational infrastructure strength is to be assessed on a 6 point grading system as follows:

1. No infrastructure
2. Crude infrastructure
3. Outdated infrastructure
4. Nominal infrastructure
5. Good infrastructure
6. Excellent infrastructure

Where plant and machinery are not relevant, the organisational paraphernalia at the corresponding stage is taken as the system infrastructure. In such a case the system is rated as

1. Vulnerable
2. Unreliable
3. Weak
4. Average
5. Good
6. Strong

Product Technology

This criterion of evaluation of competitiveness of an industry also depends on the nature of the Product Technology.

"Product Technology can be defined as the level of Technology built into the product by virtue of its design characteristics. being employed.

Technologies range from manually designed craftsman's approach systems to scientifically designed processes fully proof tested methods handed over by the customers who are basically large industries. The levels of product and Process technologies are qualified on the basis of their life cycle standing.

1 Fading Product
2 Launch stage product
3 Mature Product
4 Mature Product with test proven results
5 Mature product with features
6 State of the Art

Process Technology

This is the criterion for adjudging the effectiveness of the process to deliver the expectations of the design. The operational controls of the process of manufacture or service should be logically deduced with proven settings to deliver the design expectations. Most of the time, a manufacturer just adopts the process control settings on the basis of documentation given by the principal. Typically therefore they will operate with only **Know-How** as applied in some other context. This know-how needs validation by addressing the original logical derivation of the settings with respect to a given design and the way the process behaves in what should be called **Know-Why**. A knowledge of **Know Why** is necessary to ensure capability to handle crisis situations. An ill-engineered process is bound to create loss of competitive advantage at one time or the other. Hence process technology is a very important technology ingredient. Its rating scales are:

1. Orally informed process
2. Documented process.
3. Process as supplied by principals "**Know How**"
4. Process established with knowledge of "**Know-Why**".
5. Process with on-line controls
6. Same as 5 with dynamic fuzzy logic triggered corrections

Skill & Knowledge Base

This is a criterion for evaluation of competence of the operational staff. This is evaluated in terms of inventory of personnel and their stated skills. This inventory shows the potential (The real performance is subject to the climate factor or motivational levels created by the management and hence is included under Managerial Approach). In this parameter only the stated skills are considered. For this purpose the resources are ranked as follows:

1. Down the lane skills developed with experience
2. Experience with marginal Technology content
3. Experience with Assorted Technical skills
4. Proven Experience & Competence Built by training

5. Same as 4 with Technical backing
6. Firm technology backed specialists

Where above system of levels is not applicable:

1. Unskilled
2. Lack of Specific Skills
3. Poor knowledge
4. Nominal knowledge
5. Good knowledge
6. Excellent Knowledge

Systems & Practices

Modern manufacturing or service operations are too complex to be properly understood by the average human being. It is important that the human response in routine operations is guided by a documented system. This is necessary because the human brain, which should run the system, is not free enough during routine to think and react to what is to be done. Hence the inculcation of a system, specification of a procedure and documentation of a practice, is required to ensure error free operations. It is in this context that deliveries from a given technology are heavily dependent on systems and practices. Efficiency and effectiveness arise out of systems. Thus for example the operations of an enterprise involves systems & practices encompassing systems such as, Maintenance system, inventory system, self-certification system for quality, first off set-up approval practice, etc. These would significantly contribute to the competitiveness of the company by giving raise to better deliverables as compared to industries operating without these systems.

The rating scale definition for this parameter will be:

1. No systems & Practices
2. Oral systems in certain instances
3. Documented systems at critical places
4. Documented systems at critical places with cursory implementation checks
5. Wide ranging application of systems & Practices with review procedures
6. Same as 5 with constant monitoring

Information Support

The Operational efficiency of modern enterprises are very largely dependent on the Data and information support available for the decision making process for problem resolution at any stage.

The presence of data does not contribute to the appropriateness of operations. Data is inanimate and it needs to be converted into information, which can speak and stimulate responses in the form of reaction. SME's put low priority on information due to their operational

compulsions. Data has to be intelligently converted into information so as to facilitate proactive and reactive managerial actions. Information is also very essential to measure performance; and, what is not measured can not be controlled. The need for information to monitor actions cannot be under-emphasised. The lack of *apriori* information is very often responsible for decisions that did not deliver results. Also, the magnitude of information support many times is responsible for speedy diagnosis of problems and effective remedy administration. The magnitude of information support should also be compatible to the managerial rank at which it is present if it should be called good quality information. Depending on the quality of information support available at different hierarchical levels, the information rating for an enterprise could be classified into ranks as follows:

1. Data Lacking
2. Lack of Outside data
3. Internally generated & Customer supported data
4. Objective information
5. Objective and appropriate information with manual reaction
6. System designed information & reaction support

Logistics & Optimisation Level

Logistics refers to all those support systems, which indirectly support the basic activity while providing value addition in terms of improvement of efficiency, enhancement of recoveries or reduced system losses, increased performance, ease of operation etc. For enabling easier identification, logistics are all those features without which the basic operation / activity can still take place. Preventive maintenance practices could be logistics. The use of jigs and fixtures is logistics. Inventory practices are logistics. Fool proofing guidelines are logistics. **Written Standard Practice** is a logistic. Gauge calibration practices are logistics. First off inspection is a logistic. Material Handling devices are logistics. Testing gadget with enhanced capability is logistics. Tool identification tags are logistics, Die History Cards are logistics, Material Standards are logistics, etc. The benefit of logistics would be mostly indirect, but they could be direct. A well designed **Work System** is a powerful logistic. **House Keeping** plays in a big way on operating efficiencies and is to be treated as part of logistics. In order to be competitive the company has to integrate these concepts at each of the stages of its operations failing which there could be serious deficiencies in performance leading to lack of competitiveness.

Optimisation is no longer a buzz word; it is a science and a technology today. This technology needs to be firmly incorporated in every activity. Briefly stated, optimisation is ensuring the use of best practices and best technology. Optimisation is ensuring that nothing better could be done. Optimisation could be taking a balanced decision in a situation of opposing consequences; for examples weighing the decision on keeping

more stock against the decision on not blocking capital in cost of materials stored. Optimisation is an expert knowledge. However, the very thought of working towards it could get the company closer to it. The level of optimisation is coupled with logistics to decide on the rating for this parameter.

The judgement criteria for **Logistics & Optimisation Level** is ranked as:

1. Logistics not thought of
2. Low level logistics
3. Unscientific Logistics
4. Logistics without Optimisation
5. Logistics with crude Optimisation
6. Logistics with derived Optimisation

Managerial Approach

The Managerial Approach is a criterion, which is centred on evaluation of the top management's approach to running the enterprise. This factor considers the vision and mission of the management, its leadership style towards motivating staff to achieve results, the degree of scientific approach to problem solving, Management abilities and commitment to cost effectiveness and cost control. Since this factor is responsible for performance of every other aspect of operations, its influence is all pervasive. Also, managerial ability to make financial review dynamically and control financial indicators is very crucial for achieving sustained profitability. Hence it is evaluated as a distinct stage of operations rather than as a parameter accounting for competitiveness in a restricted area. This evaluation is done with reference to a number of parameters of Managerial approach and there is provision in the methodology to examine the strengths with respect to generalised set of parameters and also to customise the evaluation with respect to specific enterprise as well. This is also dealt with elsewhere in the manual.

COMPETITIVE ADVANTAGE THROUGH TECHNOLOGY PARAMETERS

The competitive advantage a company secures is a function of how the Technology parameters match with one another and also with the product being manufactured vis-à-vis market forces and demand forces. While at any stage of manufacture, what matters in terms of competition is an integral performance of the parameters to create and sustain demand forces, it is necessary to evaluate the contribution of each of the parameters towards the success or failure in competition. This can lead to development and implementation of a managerial reaction or precaution towards problems of competitiveness and also towards investment and technology development strategy. Assessing each parameter with respect to each competitive factor facilitates this. Specifying a rating with respect to objective criteria provides a measure of the assessment.

RATING SCALES FOR TECHNOLOGY PARAMETERS

For purposes of assessment of the level of technology, rating scales are developed for each of the parameters. A Six-point rating system is used for the purpose. A rating of 1 indicates the low end and a rating of 6 indicates the high end.

Annexure 1 furnishes the rating classifications. As per the methodology a rank of 6 is taken as an **Absolute Bench Mark**. However, Industry comparison where available could be used by specifying the strength as a percentage of the Benchmark company or Bench-Mark Practice. Thus, incorporating Bench Marking with best practices is also accounted for in the methodology.

DEFAULT RATING SCALES

Wherever the rating scales given above cannot be applied for whatever reasons the ratings shall be subject to judgement as per the following criteria:

1. Vulnerable
2. Unreliable
3. Weak
4. Average
5. Good
6. Strong

BENCH MARKING CONCEPTS

"A benchmark is an accepted best status of a product / product characteristic / process / Process characteristic in a given situation and for a company which is not at the ***Bench Mark*** *Level, provided working towards it, is its objective".*

Bench marking is the process of identifying the Best practice / Best status for a process or operation, or for the design of a product. Ideally all operations of a company and performance of its products should be bench marked to enable competitive performance in the markets. However, the issue is how to get to know the best. This is because the company delivering the best would like to continue to be the best by shielding the best practice and how it was achieved, from competitors. This is the intrinsic urge of every company to be operating in a monopolistic environment so as to reap the benefits of monopoly. Securing the best practices from the respective leaders is a mechanism of achieving Bench Marking.

Once this is done the assessors can provide ratings in percentages of the best practices of the leader. The incorporation of bench marking does not in any way affect the methodology. It is only that bench marked relative strengths will be entered in place of the current ratings in the SWOT matrix.

OVERVIEW OF STEPS IN THE ASSESSMENT PROCESS

Identification of competitive factors

The company to be assessed is given the option of choosing competitive factors on the basis of market responses. To facilitate this task they are advised to use the methodology provided in appendix 1.

The general criteria for competitiveness, namely, Quality, Price, Delivery, Service, Warranty, etc. are all accounted for in this methodology of identifying competitive factors.

Managerial and floor level appraisal

The management and the shop floor personnel are clarified about the purpose of the Technology Audit and the expected co-operation from the staff in an open session such that intentions are not suspect.

The competitive factors appropriate for the company are decided by soliciting opinion of the top management. The overview of the company and products in terms of literature and company contact data is obtained in advance. The company information is to be furnished in Annexure 2 sighted here beside and given herein. The top management is requested at this stage to identify a CAPTECH management representative, who should be an executive of the company being audited.

THE TECHNOLOGY AUDIT QUESTIONNAIRE
PART I
COMPANY PROFILE
(To be furnished by the company)

Name of the Company			
Address		Phone	
		Fax	
		E-mail	
Products Manufactured		Sector	
		Employee Strength * A/M E O	
Average Annual Sales by products	By Quantity	By Value	
Name of the Contact Person		ANY OTHER INFORMATION	
Name of the person to be interviewed			
Proposed date of interview			

* Key:
A/M Administrative / Managerial
E Floor Executives
O Operational

Obtaining Operations overview

An overview of operations and Technology is obtained through the Executives concerned. The managerial appraisal is followed up with a conducted floor visit to works to obtain an overview of operations and to obtain a basis for splitting up the operations in to appropriate stages.

Splitting Up Operations And Identifying Crucial Stages

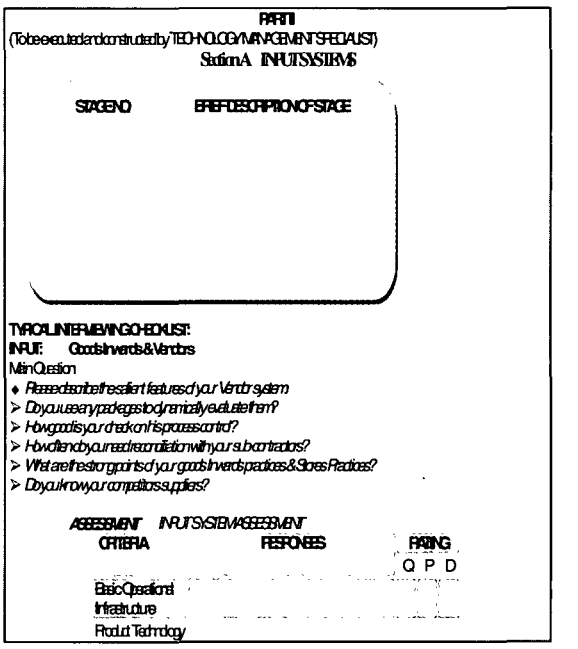
Depending on the competitive factors identified, the Operations of the company are now split into stages on the basis of product distinctions, Technology discontinuities, and, divisions & sections within the company. Out of these stages, a short listing is done on the basis of the influence of the stages on the competitive factors. Stages of activity that do not affect the identified competitive factors need not be included. An Audit team meeting will do this best. A typical Audit team could have a maximum of 3 or 4 members with one of them acting as the **CAPTECH**

ADMINISTRATOR. The Administrator will be the leader of the team. The Captech Administrator now plans stage assessment time schedules and this is handed over to the CAPTECH management representative, who is the company representative for Captech Audit. The Management representative is to work out the schedules with the respective section executives.

Assessing Technology Stage-Wise

The operations at each of the identified stages are now studied to assess them with respect to competitive strength. They are ranked as per the predefined objective criteria for ranking. Alternatively, they can be assessed in terms of the Benchmarks in percentage points. This would require the Administrator and assessors being very knowledgeable about the bench mark industry.

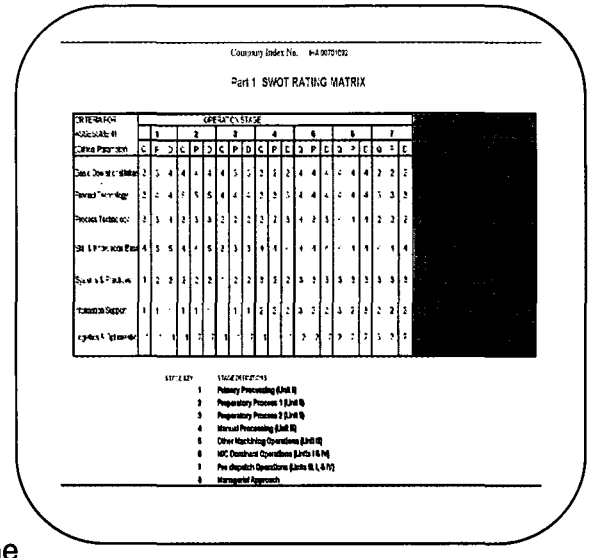
Typically 2 to 3 stages can be assessed per day and for a small / medium scale industry, identification of 6 to 8 stages will be required. This would imply about 3 days of time per audit.


PART II
(To be executed and constructed by TECHNOLOGY MANAGEMENT SPECIALIST)
Station A INPUT SYSTEMS
STAGE NO BRIEF DESCRIPTION OF STAGE
TYPICAL INTERVIEWING CHECK LIST:
INPUT: Goods Inwards & Vendors
Main Question
♦ Please describe the salient features of your Vendor system
➢ Do you use any packages to dynamically evaluate them?
➢ How good is your check on this process control?
➢ How often do you need reconciliation with your sub contractors?
➢ What are the strong points of your goods Inwards practices & Stores Practices?
➢ Do you know your competitors supplies?
ASSESSMENT CRITERIA
INPUTS \ SYSTEM ASSESSMENT RESPONSES
RATING Q P D
Basic Operations
Infrastructure
Product Technology

Preliminary audit noting should be contained in the prescribed formats sighted here beside and also provided in annexure 3. Different formats are used for different stages depending on the stage characteristics. The CAPTECH administrator should design the format, which contains the guiding / leading questions. Annexures 3, 3 A, 3 B, 3 C etc. provide alternative formats and questions for facilitating the audit team assessment about input systems. Annexures 4, 4 A, 4 B, 4 C etc. provide alternative formats and questions for facilitating the audit team assessment of intermediate conversion stages. Annexures 5, 5 A, 5 B, 5 C etc. provide alternative formats and questions for facilitating the audit team assessment of output stage operations. Annexure 6 gives the format for the evaluation of Managerial Approach. The ratings are ideally obtained through joint consensus of the audit team. The ratings reflect the strength / weakness / opportunity / Threat perceptions to the technology in use.

Obtaining The SWOT MATRIX

The ratings at all the stages are integrated to get the SWOT matrix. The typical SWOT matrix is sighted here beside and also provided in annexure 7. A typical SWOT Matrix gives over a hundred indicators of competitive strengths of the company. Conclusions regarding the technology strengths and weaknesses depend on the ratings in the SWOT matrix. Analysis is made by drawing upon the average the strengths across columns and rows to eliminate the effects of subjectivity in the assessment.


Part 1 SWOT RATING MATRIX

Normalising The SWOT MATRIX

The SWOT MATRIX gives strength indices of parameters. These indices do not possess Cost & effort parity to facilitate weighing against one another and, for prioritising and implementing strategies. Hence they are normalised using the concept of a normalizing vector. The audit team will choose the normalising vector in consultation with the management. A typical normalised SWOT matrix would be as shown in Annexure 8. The Normalising Vector is not applied on the parameter Managerial Approach, which is treated as a stage. (Last stage).

NORMALISED SWOT MATRIX Company Index No. ZZZ

CRITERIA FOR ASSESSMENT (Critical Parameter)	OPERATION STAGE 1 Q	P	D	2 Q	P	D	3 Q	P	D	4 Q	P	D	5 Q	P	D	6 Q	P	D	Normalising Vector
Basic Operational Intrac	18	15	15	15	15	9	15	15	15	12	9	6	15	12	12	12	12	9	3
Product Technology	10	10	10	8	8	8	10	10	10	8	6	4	10	8	8	10	8	6	2
Process Technology	5	4	4	5	5	5	0	5	4	5	3	3	5	5	5	5	5	4	1
Skill & Knowledge Base	5	5	6	3	4	4	5	5	5	5	3	3	5	3	3	4	3	3	1
Systems & Practices	5	4	4	5	5	5	5	5	5	5	3	2	5	3	3	5	5	3	1
Information Support	6	4	4	8	10	10	6	6	6	4	4	4	8	8	8	4	6	6	2
Logistics & Optimisatio	9	12	15	12	12	12	6	6	6	9	9	9	12	12	12	6	3	3	3
Owts	78	78	78	78	78	78	72	78	78	78	78	78	78	78	78	78	78	78	42	42	42

STAGE KEY: STAGE DEFINITIONS
1 Design & Prototype Testing
2 Customer Support
3 Electrical Circuit Design
4 Manufacturing & Planning
5 Sub-Assembly & Testing
6 Final Assembly & Testing
7 Managerial Approach

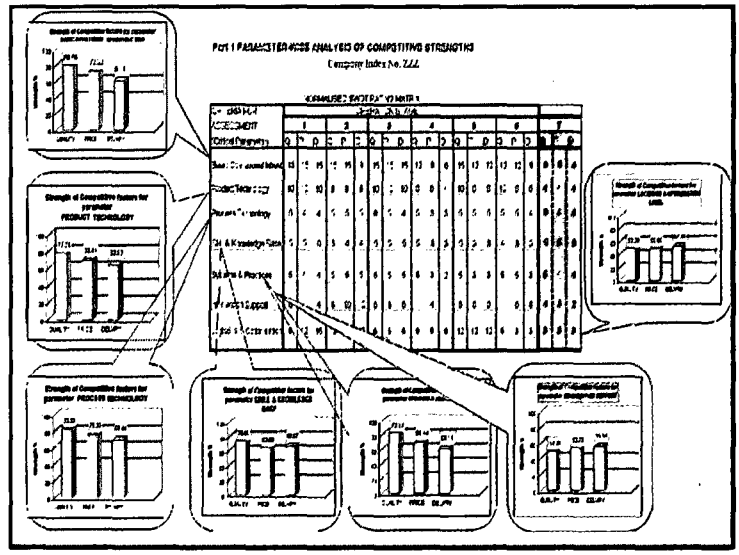
ANALYSIS FROM NORMALISED SWOT MATRIX

The analysis of strengths / Gaps is now deduced using the elements of the normalised SWOT matrix. Analysis is made in such a manner as to facilitate pointers for objective managerial action / strategy. Given herein are the different types of analysis pictures / information which can facilitate managerial follow-up. Analysis is provided in terms of strength on a 100 % benchmark basis. This implies that 100 % strength is what is expected in an ideal

company. Therefore it should be taken that a 70 % strength indicates a 30 % Technology Gap in the particular parameter with respect to the particular competitive criteria.

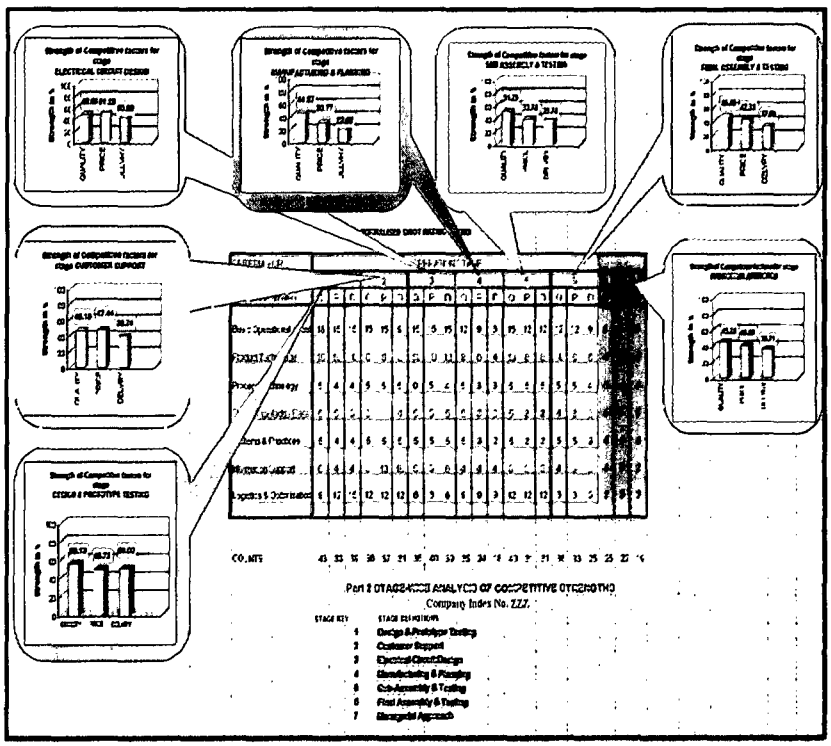
PARAMETER-WISE ANALYSIS OF COMPETITIVE STRENGTHS

This analysis is aimed at providing information on the competitive strength with respect to a given parameter. Typically the analysis would bring out a display with statistics as shown here beside and as provided in annexure 9. It enables identification of the Technology parameter, which is responsible for the Technology Strength or weakness with respect to a given competitive criterion.



STAGE-WISE ANALYSIS OF COMPETITIVE STRENGTHS

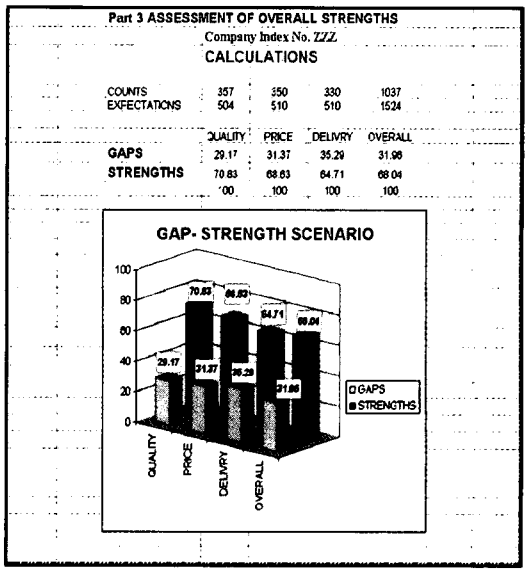
This analysis is provided to enable the management to initiate enhancement of competitive advantages by identifying the stages which are weak and separating them from the stages which are strong for any given competitive criteria. It will logically identify investment and strategic decisions that would be required. It will also facilitate stage-based prioritisation for upgradation / investment. This will enable adaptation of a strategy instead of initiating action leading to massive total upgradation of technology, which is usually out of the reach of the SME sector. The management should react to the strengths / Gaps on the basis of the prioritised action plan which is provided with a link to the stage-wise analysis. The



stage-wise analysis of competitive strengths is sighted here beside in addition to providing the details in annexure 10.

ASSESSMENT OF OVERALL STRENGTHS

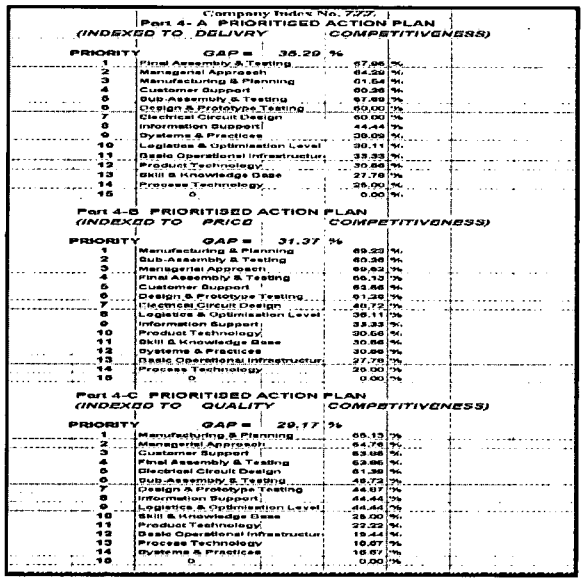
The aggregate strength of the company is required for prioritising the follow-up actions. Aggregate strength is the combined strength of all parameters and all stages taken with respect to competitive criteria. Annexure 11 provides the depiction of these strengths. This depiction is also sighted here beside for convenience of identification. This enables the identification of the weakest competitive link. This link is the basis for initiation of Technology upgradation / Investment strategies for the company.


Part 3 ASSESSMENT OF OVERALL STRENGTHS
Company Index No. ZZZ
CALCULATIONS

COUNTS	357	350	330	1037
EXPECTATIONS	504	510	510	1524

	QUALITY	PRICE	DELIVRY	OVERALL
GAPS	29.17	31.37	35.29	31.98
STRENGTHS	70.83	68.63	64.71	68.04
	100	100	100	100

PRIORITISED ACTION PLAN FOR GAP RECOVERY


Company Index No. ZZZ

Part 4- A PRIORITISED ACTION PLAN
(INDEXED TO DELIVRY COMPETITIVENESS)

PRIORITY	GAP = 35.29 %	
1	Final Assembly & Testing	97.96 %
2	Managerial Appraisal	84.36 %
3	Manufacturing & Planning	81.64 %
4	Customer Support	80.36 %
5	Sub Assembly & Testing	97.69 %
6	Design & Prototype Testing	60.00 %
7	Electrical Circuit Design	60.00 %
8	Information Support	44.44 %
9	Systems & Practices	38.09 %
10	Logistics & Optimisation Level	30.11 %
11	Basic Operational Infrastructur	33.33 %
12	Product Technology	30.86 %
13	Skill & Knowledge Base	27.78 %
14	Process Technology	25.00 %
15	0	0.00 %

Part 4-B PRIORITISED ACTION PLAN
(INDEXED TO PRICE COMPETITIVENESS)

PRIORITY	GAP = 31.37 %	
1	Manufacturing & Planning	89.23 %
2	Sub-Assembly & Testing	80.36 %
3	Managerial Appraisal	80.42 %
4	Final Assembly & Testing	86.13 %
5	Customer Support	83.86 %
6	Design & Prototype Testing	91.26 %
7	Electrical Circuit Design	40.72 %
8	Logistics & Optimisation Level	38.11 %
9	Information Support	33.33 %
10	Product Technology	30.66 %
11	Skill & Knowledge Base	30.86 %
12	Systems & Practices	30.86 %
13	Basic Operational Infrastructur	27.78 %
14	Process Technology	25.00 %
15	0	0.00 %

Part 4-C PRIORITISED ACTION PLAN
(INDEXED TO QUALITY COMPETITIVENESS)

PRIORITY	GAP = 29.17 %	
1	Manufacturing & Planning	85.13 %
2	Managerial Appraisal	84.76 %
3	Customer Support	83.98 %
4	Final Assembly & Testing	83.98 %
5	Electrical Circuit Design	61.38 %
6	Sub-Assembly & Testing	48.72 %
7	Design & Prototype Testing	44.87 %
8	Information Support	44.44 %
9	Logistics & Optimisation Level	44.44 %
10	Skill & Knowledge Base	28.00 %
11	Product Technology	22.22 %
12	Basic Operational Infrastructur	19.44 %
13	Process Technology	16.67 %
14	Systems & Practices	16.67 %
15	0	0.00 %

On the basis of the analysis of the findings it is necessary to initiate actions in a planned manner. This plan for technology upgradation or updation is to be prioritised. The decisions of updation are usually investment oriented. The priorities are determined on the basis of the degree of their expensiveness and degree of reformation called for by the action. The analysis is therefore designed to suggest a prioritised action plan based on the magnitudes of the gap. This would be as sighted here beside and is displayed with better clarity in Annexure 12.

RECOMMENDATIONS

On the basis of the analysis and prioritised action plan recommendations can now be made. Depending on the degree of cost and effort involved the recommendations are classified as follows:

1. Straight forward options
2. Reformation Options
3. Strategic Investment and Technology Upgradation Options.

Straight Forward Options
These are options involving simple managerial determination to implement changes. They do not involve significant investments. They may be changes such as change of work system, Change of documentation and corresponding change of procedures, procurement of simple gadgets to improve logistics etc. These options may also involve training of personnel.

An enterprise, which has not developed the capacity to operate a given technology efficiently, will find it more and more difficult to operate sophisticated Technologies with competitive advantage. Many times, the advanced technologies could cause more difficulties and result in more inefficiency being built into the system. These recommendations are generally centred around the parameters, Skill & Knowledge base, Information support, Systems and Practices and Logistics and Optimisation level.

In general these options will involve Managerial commitment at marginal costs

Reformation Options
These are options, which call for considerable managerial effort in terms of implementation and adjustments. These recommendations would require interdepartmental liaison and will have to be implemented taking the persons involved into confidence. They may be recommendations calling for evolution of newer systems and practices, change of layout, implementation of Operational changes, procurement of software and training personnel for the same. Generally, such options will involve major operational changes. They may involve decisions such as change of product mix or change in policy decisions currently prevailing.

The managerial actions in these cases will call for relatively lower levels of investment. These reformations could imply implementation lasting over 2 to 3 months. These decisions could be phased out depending on the complexity of implementation.

In general these options would require major operational practice modifications and cost commitments.

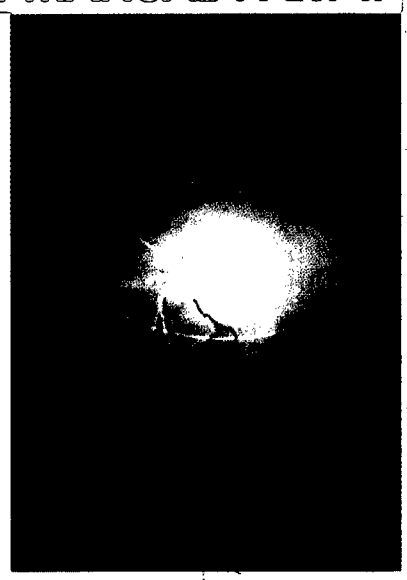
Strategic Investment And Technology Upgradation Options
These are essentially strategic options. They would require a managerial appraisal for the implementation since they would necessarily involve changes / procurement of plant and machinery or Basic Operating Infrastructure. There is necessarily an element of Investment

associated with the option and hence economic feasibility needs to be evaluated separately. These options may also involve Technology Transfer from other leading organisations.

These recommendations are centered on the need for Investment planning or Partnership planning to update the level of Technology. They are necessarily strategic decisions involving capital based judgements and managerial thoughts about the same. They may usually involve the parameters of Basic Operational infrastructure, Product Technology, and Process Technology.
The recommendations in this area are aimed at preparing a company for Technology Absorption.

By implementing the recommendations considerable competitive advantages could be retrieved. The CAPTECH Audit therefore furnishes a scientific methodology of establishing / retrieving competitive advantages for a given organisation.

CAPTECH MANUAL PART II



APPRAISAL OF METHODOLOGY FOR USER INDUSTRY

THE UNIDO CAPTECH MANUAL

PART II METHODOLOGY TO USER INDUSTRIES

PREAMBLE TO TECHNOLOGY NEEDS ASSESSMENT

Technology needs assessment is a mechanism for determining the weak operational areas in an organisation with respect to efficiency, cost effectiveness, and hence competitive advantages through Quality, pricing etc. Technology, which is always in a dynamic state, is responsible for making yesterday's decisions erroneous for today. The errors arise out of the differences in the technology of a product over time. The busy operational schedule of entrepreneurs does not give them a chance to think about the possibility of the past decisions being erroneous for the current time and becoming invalid in the future. The seriousness of the inability to review the past will throw up challenges in the market place. These challenges cannot be handled without the support of technology. A technology needs assessment activity will expose these challenges and enable proactive initiatives. Such initiatives are very vital for economies in transition and economies using market protectionism. When protections are removed towards movement to open markets, the corresponding industries will find that their lack of exposure to competition will adversely affect them. The Technology needs assessment exercise through Technology Audit is meant to expose the internal weaknesses of the enterprise and also the external threats for them. A scientifically designed Technology Audit process accomplishes the Technology needs assessment. The UNIDO CAPTECH tool is exactly designed to serve this purpose.

The report of the technology audit is designed in such a manner that it could suggest objective managerial actions to retrieve

- loss of efficiency in turnover,
- competitiveness on different criterial
- Market reach through quality
- Customer confidence through many other issues.

TECHNOLOGY ASSESSMENT – A FORERUNNER FOR INTERNATIONAL PARTNERSHIPS

International competitiveness arises out of abilities to face global levels of technology. Developing economies give exposure to only local level technology. It would be wiser to get into the ambit of international partnership to learn handling of international challenges in marketing through demand and sustained profitability. This is because, the learning and acclamatisation that could take 6 months through partnering could take 5 years with first hand experience.

The CAPTECH technology Audit tool will identify mechanisms of creating a base fabric to take on proof tested international practices and to enable smooth transition and sustenance. Seeking and sustaining operations through partnering will become easier with tuning to the findings of the Technology Audit. Therefore the logical forerunner for seeking international partnerships will be getting a CAPTECH administrator to assess the company. UNIDO, has amongst its many tools meant for assisting industry, this technology needs assessment tool called CAPTECH.

Technology for Competition

Playing the game of competition will become easier with Technology reach as against financial reach. Therefore, Industries should seek CAPTECH administration to know the rules of the game and the vulnerability as well as their strengths with respect to competition.

APPROACH TO TECHNOLOGY NEEDS ASSESSMENT

IDENTIFICATION OF COMPETITIVE FACTORS

The CAPTECH tool can be administered once the appropriate **competitive factors** for the company are chosen. This is to be chosen from among a potential list of competitive factors.

The following set of competitive factors are suggested:

1. Quality
2. Price
3. Delivery
4. After Sales Service
5. Flexibility
6. Aesthetics and Ergonomics
7. Environmental Considerations

The enterprise being audited is required to choose any three competitive factors from the above list depending on customer feed back. *

Each of these factors is briefly explained for clarity of purpose.

Quality Competitiveness

Once upon a time the manufacturer certified Quality. However in the present scenario the Customer decides on Quality. From the customer's point of view, conformance to specifications is today taken for granted. Quality is a factor taken beyond the concept of excellence, and it includes criteria of customer delight and criteria such as conveniences not imagined by customer, **CUSTOMER AMAZEMENT.** In this context, Quality is taken to include issues of Reliability. Quality is a very powerful competitive criterion.

During the assessment of Technology strength for the competitive factor Quality, whenever, Quality system errors or deficiencies are noticed during assessment, quality competitiveness will carry low ratings.

Price Competitiveness

Price is imagined in comparison to the value the product gives to the customer. It cannot be taken as the ruling market price of other products in the market without going into the value contained in the product. It should be taken as what the customer is willing to pay for the value in the product with respect to brand equity. For example, when concerned with the price of a Telephone, one cannot go into the price of the average telephone available in the market when he is providing for a cordless telephone. Price competitiveness and demand should not be mixed up while talking about price competitiveness. Price Competitiveness is a criterion wherein ratings depend on the potential ability to reduce price for a given margin of return. In effect, this implies the ability to reduce the cost since Price is the aggregate of cost and margin of profit. However, the ability to reduce cost is assessed on criterion of productivity, effectiveness, efficiency, and ability to distribute overheads over a wider base of turnover. Such issues with respect to the enterprise are examined while ranking with respect to price competitiveness.

During the assessment of Technology strength for the competitive factor Price, whenever, scope for reduction in cost is noticed in the operations are, Price competitiveness will carry low ratings.

Delivery Competitiveness

This criterion refers to the ability to hold on to delivery commitments without taking recourse to crisis management actions such as overtime, outsourcing, and such other means to prevent lapses. It is the ability to achieve faster deliveries without consideration of delivery reconciliation. Delivery strength is basically derived from ability to control and manipulate cycle time by exploiting operating capacity. During the assessment of Technology strength for the competitive factor Delivery, whenever the operating capacity for turnover is not fully exploited, delivery competitiveness will carry low ratings. This may arise out of bad planning, low utilisation or whatever.

Competitiveness through After Sales Service

Generally, this refers to after sales service such as Warranty, Replacement, etc. However, it should also include any assistance required by the consumer including issues connected with use at the customer's end. In certain situations it may also include installation / Set-up assistance, training on use and trouble shoot assistance.

During the assessment of Technology strength for the competitive factor After Sales Service, whenever the product design is not conducive to speedier service disposal for the customers, the technology level for competitiveness in After Sales Service, will carry low ratings. This may arise out of low reliability, poor design, and lack of use of modular product development concepts.

Competitiveness through Flexibility

Flexibility for Competitiveness is a criterion by which a customer is attracted to the seller or a Business is attracted to another business (in a B 2 B) situation, on the basis of the convenience provided by the seller / Business in terms of facilities and ease of adaptation to the requirements of the Customer / Client / Business.

Flexibility competitiveness could be in the form of

- provision for reasonable design review
- provision for drawing amendments
- incorporation of customised features
- provision for reasonable order review
- provision of credit etc.

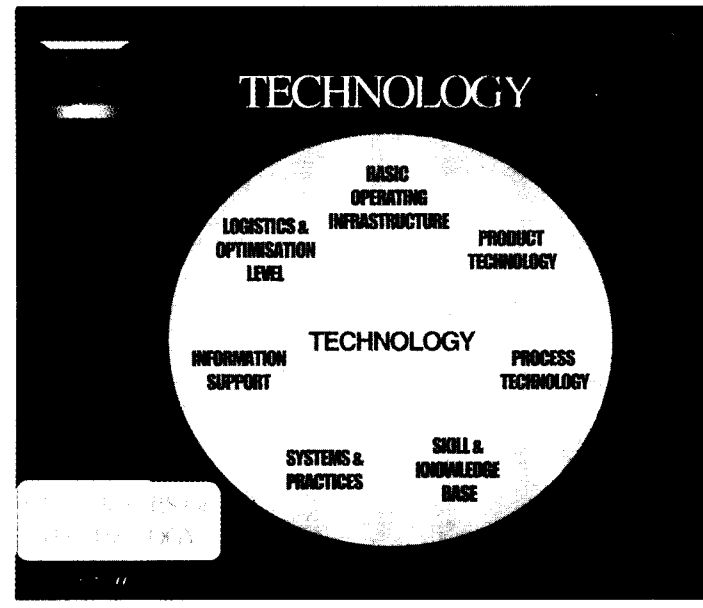
It will also include Customisation, variety, order amendment facility etc..

Competitiveness through Aesthetics and Ergonomics

This criterion provides for customer expectations of better marketability. For example when a machine tool manufacturer is the customer for a company manufacturing a module within it, he would look out for gaining advantage for his machine by virtue of the Ergonomics built into his modules.

Competitiveness through Environmental Considerations

In the world today, industries that contribute to environmental degradation will have to face governmental sanctions as well as public outcry. The enlightened society will probably shun such industries in future. Therefore product manufacturers are to show their sensitiveness to environmental considerations. These considerations will include the magnitude of environmental problems created by the companies; it may be in the form of effluent biodegradable waste, or scrap disposal calling for unfavourable BOD (Bio chemical Oxygen Demand). Competition could mean inclusion of such considerations to certain companies.



TECHNOLOGY DEFINED

For purposes of Technology needs assessment a comprehensive definition of Technology is to be first created.

Technology is taken as the collection of all the input efforts and parameters which will enable the delivery of the product.

PARAMETERS OF TECHNOLOGY

These inputs, which can be called the constituents of Technology, are schematically depicted here below, and provided in annexure 13. The CAPTECH process identifies 7 parameters into which all inputs can be fitted. These are:

- **Basic Operational Infrastructure**
- **Product Technology**
- **Process Technology**
- **Skill and Knowledge base**
- **Systems & Practices**
- **Information Support**
- **Logistics & Optimisation level**

Technology needs assessment is in effect, an assessment of the strengths of the company in these technology parameters. This assessment is aimed at providing objective guidelines to the management on strategic and managerial actions. Such actions are called for, in order to be able to achieve sustainable development of the product and face competition in business. The technology needs assessment process (that could be called technology Audit) would also suggest avenues and options to look for business partnerships with companies whose technology levels are superior. The idea is to provide for a WIN-WIN choice by matching complementary strengths.

Basic Operational Infrastructure

This refers to the infrastructure of the company with which the operations are carried out. It includes Plant & Machinery, and such other operational assets excluding Land & Buildings (Real Assets exclusive of land & Building). By virtue of the investment in these, the company will have to decide on the Technology, which can stand on it or fit into it. This Basic operational infrastructure has a definite bearing on the kind of technology it can "take on", and hence is an obvious competitive factor. Its levels could be defined in terms of monetary values. It is important to keep in mind that for a given product and operating volumes, the massiveness of the infrastructure may not be always meaning the competitive strength of the company. On the other hand, A massive infrastructure for a low volume outputs may be responsible for its lack of competitiveness.

The best Basic operational infrastructure has therefore to be assessed on the basis of the judgement of the Technology management expert regarding appropriateness.

Where plant and machinery are not relevant, the organisational paraphernalia of the corresponding stage is taken as the Basic Operational infrastructure. For example, for a Hospital the Basic Operational Infrastructure is the set of doctors and the equipment available. In such a case the system is rated as

1. Unreliable
2. Vulnerable
3. Weak
4. Average
5. Good
6. Strong

The basic operational infrastructure is to be identified with respect to the stage of operation, which is being evaluated.

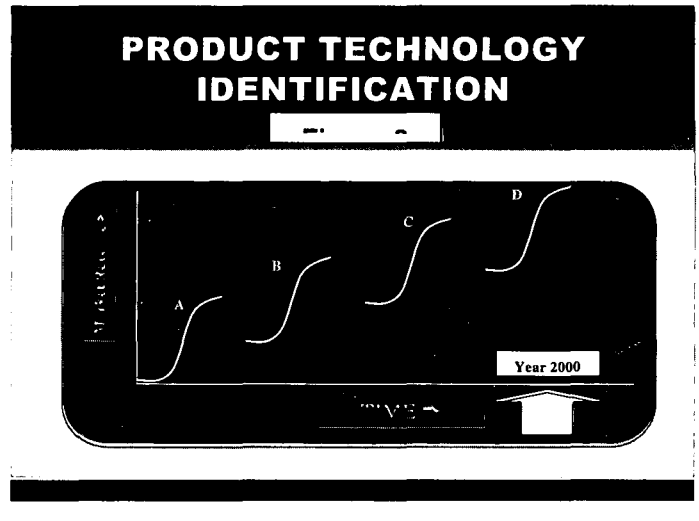
For example,
In a manufacturing enterprise, at goods inwards stage with respect to vendor evaluation, software used for evaluation is classified as Basic operational infrastructure.

In a software company, the Programmers are taken as basic operational infrastructure.

Product Technology

This criterion of evaluation of technology will bring out the level of technology built into the product by virtue of the features of the product and the design sophistication contained in it. With continuous development, progressively the society will be exposed to better and better products, which perform the same function more efficiently, effectively, and with convenience to the customer / user. An old design in such a situation will automatically lose the competitive edge and may also involve higher cost of manufacturing with lower profitability arising out of lower market share.

Consider for example different mosquito prevention devices. One could be a mosquito coil system, one could be a mosquito repellent system with mosquito mats and another could be a mosquito repellent system with repellent evaporation



dispenser. Their product technologies are not same although they perform the same function of mosquito control. The degree of competitive advantage and business potential of all the devices are not same.

The level of product technology is to be assessed on the basis of the fitment of the product into its slot on the technology life cycle. Consider the following example of the manufacturer of a Telephone unit:
Refer to the figure
The four distinct product life cycles cited are:
A: The II world war type ringer telephone
B: The dial system telephone
C: The cordless telephone
D: The Cellular Telephone hand set

If a company is manufacturing A, its product technology fitment would be: 1 ➤ Launch stage / obsolete Technologies

If a company is manufacturing B, its product technology fitment would be: 3 ➤ Mature Technology, Very good 'Know How'.

If a company is manufacturing C, its product technology fitment would be: 5 ➤ Product Adapted to manufacturing ease.

If a company is manufacturing D, its product technology fitment would be: 6 ➤ Design as per 5 involving cost effectivenss.

To adjudge the rating it is necessary for the assessor to judge the quality of the design, keeping in view, the availability of technologies for corresponding design in terms of the state of the art at the particular point of time. The purpose of this assessment should be to co-relate the support systems available for the technology contained in the design in terms of maintainability of the process, operational support available in the infrastructure for the particular product. Fading technologies, besides being less in demand, generally create operational difficulties of maintenance in terms of non-availability of spares etc.

Process Technology

While a lot of emphasis is put on Product Design in industries, generally, very little effort is put, on engineering the process to deliver the product to the design expectations, especially so in small and medium enterprises,. Most process practices stem out of what the process means and not out of what is wanted for the product. For example if one cites the necessity to solder a printed circuit board, one will think of soldering, not necessarily a ***WAVE SOLDERING MACHINE***. Further, control values for the parameters of operation of the wave-soldering machine are fixed on the basis of the available features in the machine. Critically, A technology **Know How** is thought of without much attention to a **Know Why**. This is usually the origin of problems of meeting

customer expectations on Quality. The design review procedure of ISO 9001 is basically aimed at preventing a "know-how" of one product being used to manufacture another product. There is an important necessity to establish relationships between process control parameters and product performance expectations. Process Technology is assessed in this context.

A knowledge of **Know Why** is necessary to ensure capability to handle crisis situations. An ill-engineered process is bound to create a loss of competitive advantage at one time or the other. Hence the rating of process technology is a very important.

Skill & Knowledge Base

Small & Medium enterprises are generally handicapped by having to cope with higher technologies with lower skill competencies. The problem gets compounded when technologies are incrementally updated without necessarily examining all connected issues. This kind of a situation is responsible for the absence of proper knowledge to achieve the required turnover of products in terms of Quality levels, quantity levels as well as revenue levels. SME's also generally give the training component a lower priority. There exists also a pressure to prevent unemployment through revised recruitment. These pressures would lead to a situation in which the skill and knowledge base of the operational staff is inconsistent with the job demands. The assessment of strength on the skill and knowledge base is to be looked into with this perspective. Skill and Knowledge base is evaluated in terms of inventory of personnel and their stated skills. This inventory shows the potential (The real performance is subject to the climate factor created by the management and hence is included under Managerial Approach). In this parameter only the stated skills are considered.

Systems & Practices

Hi tech manufacturing cannot be achieved as a chance occurrence. It can only happen with deliberate planning and well-designed systems and practices. A good technology will fail with bad systems and practices. The degree of importance given to systems & practices is assessed under this criterion to facilitate the company attaching the necessary importance to Systems & Practices.

Efficiency and effectiveness arise out of systems. Thus for example the operations of an enterprise are supported by Maintenance system, inventory system, self-certification system for quality, first off set-up approval practice, etc.

Information Support

There are a number of occasions in which an entrepreneur is handicapped in his operations due to lack of proper information support. The average entrepreneur is also not capable of distinguishing between ***"data"*** and ***" information"***. The ability to convert data into useful information, which can stimulate managerial reaction when presented, is also limited in the SME

sector. The efficiency operations will be drastically different when data of achievements is converted into information and put back into a feed back loop. The ability of an enterprise and the level of application of this concept is assessed as a measure of technology strength under this criterion.

Logistics & Optimisation Level

A Logistic is a mechanism of increasing the efficiency, effectiveness or speed of operation. Logistics could thus include

- **Written Standard Practice**
- **Specific Work Instruction**
- **Work System**
- **House Keeping**
- **Use of fixtures & jigs**

Logistics account for the core competencies in many situations. The Japanese techniques are heavily centred on Logistics for achieving revenue maximisation and waste Minimisation.

Optimisation is no longer a buzzword. Optimising the product mix, looking into variety reduction, controlling inventories, Workstation Planning, Line Balancing are some typical examples of Optimisation. In operations such as press working, Strip layout optimisation very significantly contributes to cost control. The concept of optimising production run length on a manufacturing set up is most often not exploited. To facilitate the assessment of a company through judgement for the criteria of **Logistics & Optimisation Level is** used as Technology strength.

SCALES FOR TECHNOLOGY PARAMETERS

Each of the parameters of technology is assessed on objective criteria. These criteria are comprehensively depicted in Annexure 1. Ratings close to 1 indicate weak strength in parameter while a rating close to 6 indicates good strength in the parameter. The creation of such objective criteria ensures lack of subjectivity in assessment.

BROAD STEPS IN THE ASSESSMENT PROCESS

The process of assessment is expected to take approximately 3 days. The distinct steps in the assessment are detailed here below.

Identification Of Competitive Factors

A Company wanting to go through the Technology Audit must specify what are the competitive factors to be considered for the company. A Company in operation should know the market expectations in their product and hence also assess the areas in which its performance is short of market expectations.

In order to assess the customer expectations and correlate it with the product deficiencies of the company a scheme of identifying competitive factors is given. This scheme is explained under 6.1. Alternatively the company can use any other criteria to understand the gaps between the product of the company and the expectations of the market.

Once the competitive factors are identified, the fieldwork of Audit can begin. The fieldwork of audit is carried out as per broad programme outline furnished in Appendix 2.

Presentation of CAPTECH

The vital staff of the company are given an appraisal about the Technology Audit concept and its purpose through a structured presentation. Questions and interactions are encouraged in this session. The presentation is likely to take about 30 to 40 Minutes. It may be a good idea for the company management to project on this occasion the company profile and expectations to the employees as well as the audit team to merge the next step namely Enterprise Overview. After the presentation is completed, the participants must be enthused to seek clarifications and mould their own expected to last about 45 minutes.

Enterprise Overview

In this step the assessors are to be presented with the company overview by the company management. Product catalogues, Company profile, and other literature of the company are to be provided to the assessors. The company executives must realise the fact that assessors are not likely to be experts in the product area of the company. Therefore the company specialities and information about the product and competitors is to be given in sufficient elaboration. This would clarify connected issues and implications for the assessors. Also in this overview, the company should suggest a suitable person who will act as the management representative for the Technology Audit process. This person should be able to provide access to necessary information and should be capable of coordinating and arranging for stage wise audits on a day to day basis. He should also help hold on to the time schedules given in Appendix 2 which will be updated during the audit. The Management representative will also be responsible for securing the necessary documents and information to the assessors from time to time.

Floor Visits to Operations

In this step the Assessors are taken round the Operations with a crisp and quick explanation of the whole activity at the respective operational areas.

A broad guide line could be about 10 minutes for an area involving about half a dozen equipment and 10 employees scattered across 20 to 50 sq. meters of floor area.

Division Of Assessment Area / Operations Into Stages
This is achieved by carefully considering the competitive factors identified, and through an assessment of the impact of operations on the identified competitive factors by the Audit team.

Formulation Of Guiding Questions / Questionnaire
The audit is not connected with obtaining answers to pre structured questionnaire's in the form of interview. Instead the assessors will plan to extract information that is consistent with the requirement on contextual basis. However, certain guiding questions are available with them to guide the process of extraction of appropriate information. While there are a few standard questions constructed in the manual, wherever deemed necessary, the Administrator my structure specific questions for the guidance of the assessors.

Floor Appraisal
The answers to the questions are obtained on the basis of explanations in preliminary noting. The operational realities are assessed through floor appraisals by studying the operations **"LIVE"** in order to make first hand assessments with respect to competitiveness of the operations with respect to chosen competitive factors. The assessors are specially trained for the purpose.

Deducing the SWOT MATRIX
An integration of all the stage assessments will give raise to the SWOT matrix shown in Annexure 4. This gives the base ratings of the company on the basis of which the entire findings will depend.

ANALYSIS OF SWOT MATRIX

The data obtained in the form of the SWOT matrix cited above is now analysed to get the technology needs of the company.

Choice of Normalising Vector
In order to take remedial action on the basis of the findings, it is necessary to quantify the degree of loss of competitive advantage by linking it to the associated expense and effort for recovery. This is done by normalising the findings by comparing the deficiencies in the different technology parameters with respect to a common base. The normalising vector provides for creating this common base for comparison to costs of implementation of recommendation and prioritising the implementation areas.

Consider for example, a situation in which, the **Process Technology** is rated as 3 and, **Information support** is also rated as 3. To achieve greater strength in Technology, where should the priority be? Assume for simplicity a situation in which the company has a rich infrastructure of computer networking. Transmitting additional information to the required

place to facilitate speedier decisions is much easier than getting a new Process Technology. If these could be quantified in terms of cost, and if we can assume updating process technology one grade is twice as difficult as providing information for better results, Process Technology would carry 2 and Information support would carry 1 in the normalising vector. Typically, a normalising vector relationship cited below:

(General Operational Infrastructure : Product Technology : Process Technology : Skill & Knowledge base : Systems & Practices : Information Support : Logistics & Optimisation Level :: 6:2:3:1:2:2:2)

This implies that, compared to Skill and Knowledge base,

Upgradation by one unit, upgradation of General Operational Infrastructure is 6 times tougher;

Upgradation of Product technology is 2 times tougher;

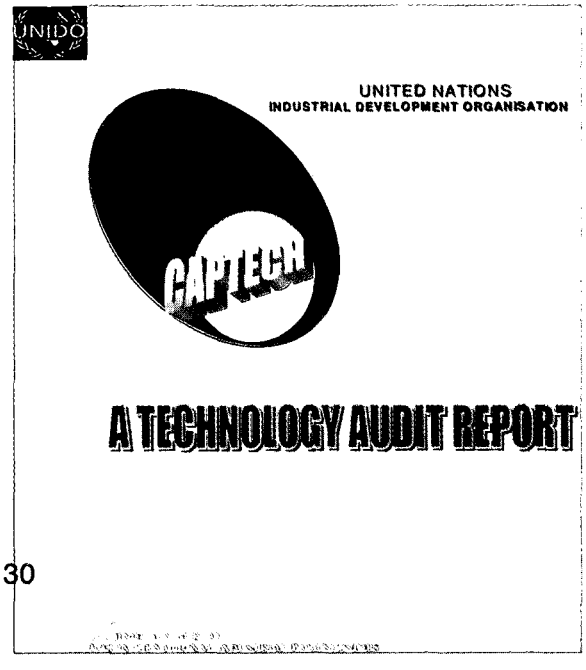
Upgradation of Process Technology is 3 times tougher;

Upgradation of Systems & Practices, Information Support, and Logistics and Optimisation level are 2 times tougher each,
for a one level increase in the respective Technology parameters.

The degree of toughness is to be taken as an integration of cost, effort and degree of difficulty involved in achieving an improvement.

The application of the normalising vector facilitates prioritisation on equated toughness basis.

THE CAPTECH REPORT



The CAPTECH report is a highly structured document, which is developed to provide the analysis of the Technology Audit. It consists of the following sections:

- Parameter-wise analysis of competitive strengths
- Stage-wise analysis of competitive strengths
- Assessment of Overall strengths
- Prioritised Action plan for Gap recovery

- Recommendations for Technology updation.

Parameter-Wise Analysis of Competitive Strengths
This analysis shows the strengths of a given parameter with respect to each of the competitive factors. It enables identification of strategic decisions with respect to the technology parameters.

Stage-Wise Analysis of Competitive Strengths
The stage-wise analysis is meant for highlighting specific work areas, which call for improvements in the wake of the audit findings. This enables understanding of the focus area for change.

Assessment of Overall Strengths
The overall strength analysis is an indication of the aggregate technology strength of the company. It can help set the vision of the company towards development. It is also used to facilitate prioritisation of the gap recovery plan by identifying the competitive factor, which has the highest gap first. It identifies the single largest competitive criteria on the basis of which the vision of the company is to be set.

Prioritised Action Plan for Gap Recovery
This is meant to facilitate objective structuring of the gap recovery plan. The plan lists the areas calling for action on the basis of descending order of priority. This plan is indexed to each of the competitive factors.

COMPETITIVE STRENGTH INTERPRETATION

Competitive strength referred to in the report identifies the potential problem areas inside the company not withstanding market conditions. The report does not get into market analysis. It is assumed that the market is best understood by the organisation.

The issue therefore will be how to get value out of the report when it is not linked to market. The report facilitates strengthening with respect to competitive factors keeping the likely strength of the competitors and not with respect to market forces.

Consider the following illustrations for clarity:
For Example, consider the competitive factor Quality (Quality competitiveness):
Quality weakness is indicated whenever an operating practice is not able to deliver the desired quality, or there exists a potential risk of losing out on quality in the particular Technology parameter at the specific stage.

If sampling plans are implemented without a monitoring on process average quality and process capability indices, the quality rating will be low. This is because the basis of the development of sampling plans is that the producer's process average is under control with stable process spread.
Similarly, if accuracy of plant and machinery is not linked to preventive maintenance the quality rating will be low; if setup approval procedures are not scientific, the quality rating will be low.

Quality rating is not just an index of the quality levels prevailing in terms of how much is the current rejection or rework.

Also for Example, consider the competitive factor Price (Price Competitiveness):
This rating determines the scope for cost reduction and it should not be mistaken for Price logic. This rating criteria operates on creating competitive edge by cutting down costs and works on the **logic *"Price = Cost + Profit"***, and that cost reduction may lead to price reduction at the discretion of the manufacturer. It simply identifies areas in which the cost of the product is getting inflated and hence the scope for deflating cost. Very obviously it indicates the scope for reducing market price; but whether price should be reduced is the company's prerogative and the assessors do not propose to venture into the issue of fixing the price.

Clearly, price rating being low is an indication of the scope for reducing the cost and hence the price; however a recovery in price competitiveness by virtue of cost reduction does not necessarily imply prices must be reduced.

For Example, consider the competitive factor Delivery (Delivery competitiveness):
Strength indices in this area indicate the scope for reducing the delivery time. It is merely an index of the possibility of reducing cycle times and order commitment feasibility. Therefore if raw material and bought out item deliveries and not scientifically planned, the delivery ratings will be low. If potential market scarcities are not accounted for in the purchase system, the delivery ratings will be low.
Delivery competitiveness could also show the existence of hidden capacities for manufacture and inefficiencies in planning and bad work systems.

The degree of delivery competitiveness indicates the ability of the company to achieve speedy deliveries and validity of delivery plan. The lack of delivery competitiveness shows the likely risk of not fulfilling delivery commitments. Delivery competitiveness being low would also imply lack of exploitation of available capacity.

However, this does not show up in systems where delivery commitment dates are unscientifically fixed. In such cases it would indicate the inability to plan deliveries on the basis of capabilities. It is however necessary to remember that the audit mechanism does assume unlimited market demand capitalisation, which may not be true in all cases.

IMPLEMENTATION OPTIONS

Built into the CAPTECH report, there is a set of suggestions and recommendations derived out of the ***"Prioritised Action Plan For Gap Recovery"***. Recommendations are provided on the basis of each of the identified competitive factors. The top priorities are identified with respect to each of the competitive factors and in all, about ten recommendations are provided. Clearly these recommendations are deduced on the basis of calculations which average out the ratings and hence the degree of subjectivity is therefore very low.

All the recommendations are classified into three categories namely,

- Straight forward options
- Reformation Options
- Strategic Investment & Technology upgradation Options

Straight Forward Options

These are simple options involving managerial adjustments in work systems arising out of technical changes over time. Due to the inertia of the operational bureaucracy several operational practices will exist on a status quo approach without changes over a period of time. These options identify such technology upgradation in terms of routine operating practices. These options can be taken up for consideration with managerial commitment at minimal costs. Considering the cost of taking steps on the recommendations the value of the results will be significant. However, it may not be possible to quantify these values through tangible calculations. They may involve streamlining, Training etc. In most cases the management can implement these options without external support.

Reformation Options

These options usually involve greater concerted effort to implement and will involve inter and intra-group commitments. They will also involve deeper commitment and an element of investment thought need to be applied in order to execute these recommendations. These recommendations will invariably update Technology at marginal cost. They may involve changes in layout, planning practices, procurement of software, training of personnel redesigning of inspection gadgets, development and deployment of new systems for calibration etc. These options may require the external assistance of consultants if appropriate skills are not internally available.

Strategic Investment And Technology Upgradation Options
Strategic options are generally long drawn investment proposals and will involve updating infrastructure, establishing new practices, and also extensive re-tuning of the organisation to a newer set of work practices. These options logically indicate the necessity to change to a newer technology in the form of technology transfer, leap frogging etc. These options can be classified as Capital investment options needing feasibility evaluation. The options will necessarily involve generation of additional funding.

GUIDELINES FOR UNDERSTANDING & IMPLEMENTATION OF REPORT

The CAPTECH report is generated out of multiple links between Parameters of Technology and stages of manufacture as reflected in the Prioritised action plan. Hence for the average SME it may tend to be brain teasing to understand the mechanism of generation of the report. Notwithstanding this it is important for the beneficiary industry to understand how to implement the findings in the report to the company's advantage.

In order to facilitate this, guidelines are provided in Appendix 3. This appendix will be mailed to the company along with the report. This will enable the entrepreneur / company to implement actions which will bring about Technology strength enhancements.

Appendix 3 also provides examples to clarify the method of focussing action into a specific area without causing any vagaries. The corrective actions will be highly objective due to the mechanism of the assessment.

For further clarifications if any, the Administrator will be able to clarify issues and recommendations. Two post audit visits to the company will be provided subject to certain compliance requirements.

FREQUENTLY ASKED QUESTIONS [FAQ]

The following answers to frequently asked questions would facilitate understanding of what CAPTECH will do and what it cannot do.

Question 1:

IS THE METHODOLOGY SECTOR INDEPENDENT?

Yes, it is definitely applicable to all sectors.

Question 2:

IS IT NECESSARY TO HAVE A SECTOR SPECIALIST TO DO THE AUDIT?

*Out of the seven technology parameters, which are assessed, the sector specialist may be of additional advantage is assessing the strengths of **Basic Operational Infrastructure** and **Process Technology** only. In fact, the sector specialist may be at a serious handicap in assessing competitive strength in all the remaining five parameters due to his lack of exposure to the mechanics of assessment if he is not trained. In any case, mere sector specialisation will not enable the possession of the competence to implement the CAPTECH audit. Also, the absence of the sector specialist will not significantly alter the findings although in the above cited two parameters his presence will add to the accuracy.*

Question 3:

WILL THE FINDINGS OF THE CAPTECH AUDIT BE SUBJECTIVE ON THE BASIS OF THE ABILITY OF THE ASSESSOR?

When the company uses trained assessors the errors in conclusions are very minimal. The conclusions are made after averaging across 7 ratings in almost every case. The expected deviation arising out of subjectivity in individual ratings will be ! 1 on the rating scale of 1 to 6. This will imply that errors in conclusions could be of the magnitude of a maximum of (With 99% Guarantee).

$$\pm 3 \times 16.2 \times (\text{std error of subjectivity}) / \sqrt{7} = \pm 3 \times 16.2 \times 1/3 / \sqrt{7} = \pm 6.047\ \%$$

Question 4:

CAN CAPTECH HELP IN BUILDING MARKET DEMAND?

No

Question 5:

IS IT POSSIBLE FOR INTERNAL PERSONNEL TO BE TRAINED SO AS TO ASSIST IN SELF-ASSESSMENT?

The depth of knowledge required for assessing competitive strengths is deep in the field of Industrial Engineering. While it is possible to train internal personnel to develop into assessors capable of implementing self-assessment;, at the moment UNIDO does not provide training programmes for plant level personnel.

Question 6:

IS IT NECESSARY TO HAVE PERIODIC REPEAT AUDITS?

Yes. Once an application of CAPTECH is made it is for the company to take appropriate action on the basis of the guidelines furnished along with the report. However UNIDO does not directly provide assistance in taking action on the basis of report. Audited enterprises should seek assistance from industry institutions and consulting agencies. UNIDO can guide the Industry institutions and consulting agencies on the appropriate action necessary. Enterprises are advised to act on the report and ask for Post Action Audits to check whether they have taken effective actions on building competitiveness. It may be a good idea to have the CAPTECH administered at least once in two years if not once a year.

Question 7:

WILL UNIDO PROVIDE FOR AUDITS ON A STANDING BASIS?

No. However, UNIDO's manuals will be available against a price since manuals and software will be priced publications of UNIDO.

Question 8:

WILL THE CAPTECH AUDIT HELP IN RATIONALLY DETERMINING THE NECESSITY TO UPGRADE TECHNOLOGY IN TERMS OF ACQUISITION OF CAPITAL EQUIPMENT AND JUSTIFY CAPITAL INVESTMENT DECISIONS?

Yes; in fact this is the very purpose of CAPTECH methodology. Many times the capital equipment acquisition through investment is thought of only on the basis of economic feasibility in terms of profitability ratios such as IRR NPV, payback period, break-even analysis etc. All these types of analysis do not link up the capital equipment with downstream capabilities of inputs, and upstream administrative and demand links called for translating the value of increased manufacturing abilities into increased revenues. The result is that in such cases, the enterprise continues to run into profitability problems and on many occasions the enterprises turn out to be defaulters on repayments to financing institutions. On many occasions the industry turns sick due to the burden of repayment not withstanding the acquisition of sophisticated equipment. Financing agencies can avoid these problems by enforcing the CAPTECH audit as a precondition to financing for an equipment. However, it is necessary to stress here that the CAPTECH tool is not a substitute for financial feasibility analysis tools cited above or for the UNIDO COMFAR. The CAPTECH tool is only complementary to the feasibility analysis mechanisms.

Question 9:

WILL THE CAPTECH AUDIT HELP IN DIVERSIFICATION PROJECT ANALYSIS?

No.

Question 10:

WILL THE CAPTECH AUDIT HELP IN NEW VENTURE / PROJECT ANALYSIS?

No.

Question 11:

WILL THE CAPTECH AUDIT HELP IN ANALYSIS OF STRENGTHS OF SICK / NON WORKING COMPANIES?

No.

Question 12:

WILL THE CAPTECH AUDIT HELP IN ANALYSIS OF CAPACITY EXPANSION PROJECTS?

Yes.

CAPTECH MANUAL PART III

ASSESSORS' GUIDE

THE UNIDO CAPTECH MANUAL

PART III ASSESSORS' GUIDE

PREAMBLE TO TECHNICAL NEEDS ASSESSMENT

Technology needs assessment is the task of examining the technology strengths of a company with respect to the competition it is holding out in the market, and hence specifying the areas in which the company needs to be strengthened to face competition.

The SME sector in the developing countries and least developed countries has been protected from competition and hence are bread in an environment where competition has never been the ball game. In these countries, technology has not been exploited to its full potential due to the absence of the application of mind towards it.

Pressures of Quality, Cost-Price gaps, and the need to exploit operational capacities to achieve speedy deliveries arise in transition economies due to the above-cited reasons.

On one side we have a situation of obsolescence in international markets and on the other side we have the issue of ability to produce new products to generate revenues. In this kind of a scenario it is best to first understand how to operate an existing technology in the best possible manner before venturing into newer areas because newer areas are necessarily sophisticated.

> ***"A Company which cannot operate an existing technology to its best potential of advantage will find it more difficult to take on and operate newer technologies. Therefore there is a need to build technical competency into the companies."***

Technology needs assessment is to be undertaken with a view to countering the current inefficiencies before taking on advanced technologies. The CAPTECH technology Audit tool has been designed in this context.

The assessor should therefore to be able to identify operational deficiencies by field observation and integration of his own knowledge with it rather than collection of information through a questionnaire.

This is exactly what is to be done in the **CAPTECH TECHNOLOGY AUDIT**.

Technology Strength A Forerunner For International Partnerships

Developing countries are characterised by weak financial support in the SME sector. Also the level of operation of the technologies is considerably lower due to the absence of exposure to the state-of-art. Hence an alternative available for development without sacrificing self-interest is to move towards international partnerships.

A partnership will materialise and sustain only when each of the partners has complementary strengths. The Technology Audit exercise is aimed at facilitating the entrepreneur to develop these complementary strengths. The assessor should keep this perspective in undertaking the audit.

Technology Life Cycle Vs Product Life Cycle

The CAPTECH assessor should clearly distinguish between the Technology Life Cycle and the Product life cycle. A given Technology may have many manifestations of products. But each of the products could still belong to the same technology.

Consider for example the Technology of Cellular Telephones. The products within the Technology are SIM Cards for connectivity. These may be varied to give different products using the same technology.

- A memory-less SIM card may simply provide connectivity.
- A card with memory will allow a Phone book to be built in.
- An intelligent card can provide for accounting of time
- Yet another card may provide Voice activation features

With progress of time the first product may die in the absence of market support, when the second continues to work. However, all these products belong to the same Technology life cycle.
A product life cycle basically does not include the conceptualisation phase, and some part of design & prototype development phase.
The product Technology needs to be assessed in the light of the above difference.

Life Cycle Concept of Product Development

Once a prototype is generated and successfully field-tested, the product is ready for launch. It is at this stage that there is a continuous element of learning and refining the product. Very often refinements will come out of generation of core competency leading to innovation if properly steered. SME's do not generally possess the capacity to steer core competencies towards innovation. In the above process product commercialisation tends to be weak with respect to competitive factors. It is very important to aim at enhancing the value of the product because the value has a direct bearing on competition and market price, and hence on operating margins. With a static product in production the costs rarely roll back in the absence of innovation. This is where the necessity of Technology Management arises. In the absence of efficient

Technology Management, a company that does not enhance value of its product over time will find that its competitors sell the product better in a competitive environment. SME's in developing countries are generally oblivious of the phenomena of enhanced values and hence enhanced profit margins. An assessor has to carefully assess the product development and its commercialisation in the light of the above concepts.

Technology for Competition

The existence or non-existence of the capability to compete arises out of the weakness of the company with respect a set of parameters called Technology Parameters. These parameters or Technology constituents, when intelligently managed would create the ability to compete in a company. The assessor therefore is required to identify which are the technology parameters that can be managed better so as to result in competitive advantage to the company. In order to do this he has to first understand what are the elements included in each of the Technology parameters or Technology Constituents.

APPROACH TO TECHNOLOGY NEEDS ASSESSMENT

The approach to technology needs assessment consists of determining a set of Indicators and indices for these parameters to a enable the application of a SWOT philosophy. These indices should point to the strengths of the technology parameters as noticed in action. A person not necessarily exposed to the industry is doing this assessment. Therefore the assessor should develop a sense of downgrading all operations to realistic low level resolutions for strength assessment.

Take for example the operation performed by a domestic mixer / chopper. Instead of looking at the operation as grinding, one can look at it as a process of converting the product into smaller particles by physical copping. A mixer has got sharp blades, which repeatedly strike the product to chop it. The copping speed is high. The product is held in position in a grinder jar with out being gripped. Therefore the issue is gripping efficiency at high speeds. This is being represented as a technology. Clearly, there are many other implications of gripping which are not discussed herein.

TECHNOLOGY & COMPETITION

The CAPTECH methodology strongly believes that competition can be influenced through changes in technology parameters. (Refer definition in lexicon). The Technology needs are to be identified to enable enhancing competitive strength of the company through technology parameters.

INTEGRATED APPROACH TO TECHNOLOGY PARAMETERS

Technology is the totality of the process of conversion of raw materials to a finished product. It can also be taken as the collection of all the activities involved in the development and delivery of a product.

PARAMETERS OF TECHNOLOGY

As per CAPTECH technology is an integration of 7 parameters which are the technology constituents. These constituents are:

- **Basic Operational Infrastructure**
- **Product Technology**
- **Process Technology**
- **Skill and Knowledge base**
- **Systems & Practices**
- **Information Support**
- **Logistics & Optimisation Level**

Each of these constituents consist of the following:

Basic Operational Infrastructure

This refers to the basic ingredients of infrastructure. This infrastructure is the core of the existence of the company. It is explained earlier in page 30 Part II and page 12 part I.

Product Technology

This is a parameter, which indicates the degree of obsolescence of the product being manufactured in comparison to internationally available products of the same technology. The philosophy of assessment of this parameter is that the customer inherently has got an option for something better that will do the same purpose. Therefore not withstanding the degree of efficiency of the manufacturing process of the product competitiveness is lost due to availability of better products elsewhere.

Product technology also includes the magnitude of value built into the product by virtue of the design strength with respect to comparable products.

To assess product technology, one has to first identify **"Product"** at any stage of process, or identify **the value addition to the product** in that section. The value addition to the product at a given stage is the product of that stage. Assess Product Technology keeping this **Product** in mind.

Assessors are cautioned that Product Technology may not be always relevant. In such cases the Product Technology component can be omitted from evaluation.

Assessors are also advised to examine implications of product technology furnished earlier in Part II and Part I.

Process Technology

The assessment of process technology is a judgement on how the process is engineered and controlled to deliver the product that will possess the desired characteristics. It is an examination on what is wanted and how the manufacturing process ensures the resulting product possessing the desired characteristics? The assessment should aim at identifying the **efficiency** of the process to deliver expectations.

Assessors are also advised to examine implications of process technology furnished earlier in Part II and Part I.

Skill & Knowledge Base

With advancement in technology the industry is in an era where every activity requires an appropriate skill and Knowledge base to perform it. While skill is acquired by training on the job, knowledge is to be acquired by formal lectures. However, the industries in developing countries are obliged to recruit locally available personnel for the purpose. Hence very often the persons who are doing the work are not trained to do it. Also they may not have the knowledge of why a certain thing is required. When locally available task force is created, the personnel acquire the necessary skill and knowledge through ***hands-on*** mechanism on a ***Hit and Miss basis*** subject to their personal attitudes and traits.. In the light of this background the skill & knowledge base is to be assessed by the assessor.

Assessors are also advised to examine implications of Skill and Knowledge base furnished earlier in Part II and Part I.

Systems & Practices

It is olden times persons were able to spend time and attention and devotion to every activity being done for every component to ensure the right things are done. However in the modern environment time is a luxury and thinking time is not accounted for in working time. In the wake of this context, the philosophy of having Systems and Practices is one of accounting for attention on the basis of the system rather than on the basis of first hand intelligence. It is very necessary that the burden of concentrated attention be transmitted to systems in the view of the sophistication of manufacture and the scale of production. SME's should learn to do it effectively. Have they done it effectively? The answer to this question is the assessment to be carried out by the CAPTECH assessor.

Assessors are also advised to examine implications of Systems & Practices furnished earlier in Part II and Part I.

Information Support

The task of analysing vast magnitudes of data for managerial and executive action was a big puzzle in the past. With the liberal usage of computer, it is possible to get vital information from out of data in a flick. It is now for the managers to make the appropriate information available at vital places inside the operational area round the clock to achieve effectiveness in manufacture and control. However data continues to bog the heads of the thinkers in SME's. Many a time, in certain enterprises effort is put to convert the data into information. However it is not provided in the right magnitudes at the right places. The CAPTECH assessor is required to assess whether the data is processed and presented to the decision makers as vital information necessary for operational effectiveness and control or not; also, the assessor has to judge the appropriateness of the information with the operational level to which it is presented.

Assessors are also advised to examine implications of Information Support furnished earlier in Part II and Part I.

Logistics & Optimisation Level

The assessment of logistics is a tricky task. Science and Technology cannot judge best logistics; It can only be certified on the basis of the personal experience and memory bank of best practices witnessed by an assessor in the corresponding situations. Some of the items, which constitute the logistics, are specified in the earlier two sections. Optimisation is not an assessment of the mind. It is an assessment deduced by the science and Technology of Optimisation. The assessor should use his or her intellect of the science of Operations research to assess this factor. This is the task of a specialist and therefore the assessor must have a good background of Operations research to do this. The rating for this criterion is blended with Logistics and averaged out between the logistics level and Optimisation level to prevent large-scale errors.

Where Inspection is not identified as a separate stage Logistics should include support secured by Precision measuring instruments and gauges.

Assessors are also advised to examine implications of Logistics & Optimisation Level furnished earlier in Part II and Part I.

Managerial Approach

Managerial approach has been cited earlier as a Technology parameter and rightly so. However, since it affects the performance of a company with respect to every parameter and every stage, it is felt better to treat ***managerial approach*** as one stage of manufacture. During analysis therefore the criteria of evaluation of managerial analysis is to be presented with other criteria. There is no relation of these criteria to the Technology parameters. For purposes of convenience of presentation and creating a completeness of the SWOT matrix a set of other criteria are chosen herein. This is always the last stage indicated in the SWOT matrix as sighted here beside.

6			7			PARAMETERS FOR MANAGERIAL APPROACH
Q	P	D	Q	P	D	
4	4	3	6	5	4	Mission
5	4	3	4	4	4	Vision
5	5	4	5	4	4	Policy & Traget Control
4	3	3	5	5	3	Scientific Approach
5	5	3	5	4	4	Problem Resolution
2	3	4	4	3	2	Implementation
2	1	1	3	3	3	Climate

COMPETITION THE CUSTOMER'S VIEW POINT

The customer's viewpoint of competition is always value versus price. The customer is not concerned with the operational problems of the manufacturer or management. The customer's viewpoint is what he can get out of the competitive product for an equivalent price. The assessor should remember that his assessment is always with respect to competitiveness as per the customer's viewpoint. If this is not done in this perspective, the exercise is likely to lead to erroneous results.

TECHNOLOGY PARAMETERS AND COMPETITIVE FACTORS

At every stage of assessment the assessment should carry the correlation of the technology parameter with respect to the corresponding competitive factor. This is being highlighted deliberately to make the point that a technology parameter being favourable for one parameter could simultaneously be unfavourable for another.

For example, when a manual process is automated the invariable advantage is it favours better control over quality; however, it adds additional burden on cost; although a one time burden, it could be some times unfavourable to price competitiveness while pulling up the break even point. This is to be particularly borne in mind by the assessor.

SCALES FOR TECHNOLOGY PARAMETERS

Each of the parameters of technology is to be assessed on objective criteria. The criteria are as given in annexure 1. The assessor can take on greater depth into each of these parameter scales by making the definitions more objective as and when he gains expertise and experience. These criteria should be well grasped in the training sessions. They are best understood during the preliminary audits.

IDENTIFYING COMPETITIVE STRENGTH BY BENCH MARKING

In the treatment so far given it is assumed that the ratings are assigned with respect to the scales developed for the purpose. However, the assessment can also with respect to the practices in the Best (Bench-Mark) company provided such a company is identified. In such situations the SWOT matrix would carry the assessment specified as % of the best Practice Company. This would presuppose that the assessor knows the best Practice Company ***"in and out*** or ***in totality".*** The rest of the analysis procedure has been so designed that it does not however alter when bench marking is used instead of the predefined rating scales. Therefore the CAPTECH methodology is equally applicable whether the assessment is based on rating scales or based on Bench Marking with respect to the best company.

RELATIVE BENCH MARKING & ABSOLUTE BENCH MARKING

Bench Marking is always a relative concept. It presumes that the Benchmark Company is unbeatable. This is not necessarily a tenable argument in the ever-changing world of technology. However, it is being used with the in-built assumption that the bench marked company is always the **Leader**. This is a hypothesis, which will be true in the short run, particularly with respect to developing countries in general and SME's in particular. Since all leaders are necessarily dynamic Benchmarks will be dynamic. The strength shown through benchmarks does not necessarily show the degree of absolute gap in any factor.

Absolute benchmark is one, which does not alter. A rating scheme developed on the basis of rating scales cited herein can be interpreted as an absolute benchmarking approach. In such schemes, hopefully, the highest rating is unbeatable provided the scales have been evolved with a good thought process. However, good thought is not the proprietary property of any single person including the author of this text.

It is expected that the scheme discussed without the context of benchmarking will sustain as an absolute bench mark criteria for a reasonable span of time.

It is important to note that in a changing world a given company will find it wiser to get the CAPTECH methodology applied to the company across periods of

time not lasting beyond 2 to 3 years. Therefore the Life of the Audit report is likely to be 2 years. There is a reasonable chance that the rating scales will give the highest rank against unbeatable criteria in view of the short life of 2 to 3 years.

It is important that the assessors note that the rating scales developed are not absolute in the time domain. However, these rating scales are likely to hold out over the span of next 3 years at least. Beyond this period, the Administrators are encouraged to vary the scale definitions consistent with the changes in the environment. However, they are cautioned against doing it when their personal experience is low.

SUBJECTIVITY AND OBJECTIVITY ISSUES IN EVALUATION

Not withstanding all the caution and care taken in establishing the methodology, subjectivity elements are bound to creep into the analysis during initial phases of audit. A set of subjective evaluations when averaged across for purposes of generating recommendations will ensure objectivity in the recommendations. This is an important premise on the basis of which the analysis methodology is designed; the analysis is based on averages. It can thus be largely assumed that the results of application of the methodology will be unbiased and objective.

ASSESSING METHODOLOGY

The CAPTECH assessment of technology needs is based on an interview cum live operation check. It is not based on data obtained in the form of a questionnaire response. It is also not based on written down procedures and documentation control. It is a reflection of the practice of operations obtaining during the design and development, during the shop floor processing of the product and across the delivery mechanism.

QUESTIONNAIRE -ADMINISTRATION VS. INTERVIEW & FLOOR INSPECTION FOR AUDIT

Traditionally assessments are made by Questionnaire administration on the basis of responses. This approach is not used herein. The approach used is one of interviews to obtain data about operations through interviews, and then understanding the data about operations by examining operations live and in action and transforming the data and operational facts into a rating. This would require deliberate planning for the type of information to be looked for. This is done by pre-structured guiding questions. The process would also require the assessor to possess a certain amount of competence and Technical depth in understanding the operations with a view to gap detection. The process of technology Audit is not amenable to in-house self-assessment due to this reason.

Optimal CAPTECH Administration Team

A team of 3 assessors, consisting of One Administrator and two assessors will implement the CAPTECH administration on a company in an ideal situation.

The team of three is lead by an **Administrator** who is a seasoned professional. The administrator is responsible for generating the CAPTECH report based on consensus of the team. In the event of lack of consensus the decision of the Administrator is final.

Team allocations

The assessment team should preferably earmark among themselves specific tasks as per the following descriptions:

Document stacker

During the audit process data is to be gathered from discussion and floor inspection. Many times it may not be feasible to get the necessary documents on the spot. It must however be collected to complete the audit. The Document Stacker is responsible to keep track of the requirements and to take follow-up steps to ensure that the data / documents are secured before closing the audit.

The Document Stacker is responsible for securing

- Company contact information in annexure 2
- Company profile & Product catalogues
- Documents called for during the audit process

The document stacker shall also keep custody of documents provided for temporary reference to the audit team. He shall ensure that these documents are given back to the appropriate officials before closing the audit.

Monitor The monitor is the time-keeper of the team. He is responsible to ensure the completion of the audit in a timely manner. He should co-ordinate with the management representative in arranging for interactions floor visits, verifications etc. He is responsible for ensuring the progress of the audit as per planned schedules given in appendix 2. He / She is also responsible for casting revised schedules as and when required during the process of audit. The approximate time for auditing one stage is 90 Minutes inclusive of interaction time. The Monitor shall keep in close touch with the Management representative and keep him posted with audit difficulties as per directions of the CAPTECH administrator.

He should keep track of the contact executives at each of the stages. He will be responsible for keeping a checklist of pending items and should constantly remind the administrator about the status of progress and future plan of action.

STEPS IN THE CAPTECH ADMINISTRATION:

The following are the distinct steps in the CAPTECH administration process:

Preparing the company for Audit

Once a company is identified for audit, the company has to be tuned to receive the audit. This is done by using the make ready kit for CAPTECH audit as per appendix 3.

First a standard letter is to be addressed to the company which has requisitioned the audit. The proposed letter can be as given in form 1. This form 1 is linked to a mail merge tool in MS Office or any other software with such a function. This letter could be developed in a standard format linked to an appropriate data-base whose field structure could be as furnished in form 2 in appendix 3. Before a visit is undertaken for the audit it is essential to ensure readiness as per checklist given in form 1.

The dates proposed in form 1 should provide for sufficient time for company response as well as Audit planning. If companies do not comply with requirements in form 1, it is not advisable to undertake such audits as difficulties are expected in such cases. Therefore letter in form 1 is only a tentative schedule.

While dispatching form 1 it is necessary to ensure that the enclosures cited there in are contained in the dispatch. The assessors should be thorough with criteria for identification of competitive factors and should guide the industry in doing it. If required the assessors may schedule one extra session of 90 minutes to identify competitive factors where the company pleads its inability to identify competitive factors.

The structured time values are initially committed for only day 1. The subsequent schedules are to be worked out with greater awareness of the company on the first day.

The SME sector would most often find it difficult to provide direct projection facility and hence the assessors should be prepared to make presentation through OHV.

Pre-Audit Steps

- **Identification of Competitive Factors**

  If the company has already identified competitive factors, the audit team is ready to proceed as per schedule. Otherwise, on the basis of the awareness of the inability of the company to identify competitive factors, the audit team should quickly check appropriate data / records / activities and help the company to identify competitive factors. In such a case, a guide line may be given for the company to identify competitive factors.

Audit Steps

The following are the broad outline steps of the audit:

- **Sensitising the personnel for CAPTECH**

  The CAPTECH administrator will present the CAPTECH through an overview presentation available in the CAPTECH software, which will be supplied as a CD to qualified Administrators / authorised institutions. Alternatively transparencies may have to be used depending on the facilities available. The person making the presentation (Preferably the administrator) shall encourage questions from the first line supervisory staff who must be available during the presentation in addition to the hierarchy of heads / Managers. The administrator should take abundant precaution to ensure that he sends down the audience the message that ***"it is not connected with anything to do with employee performance assessment."***

  During the preliminary managerial interaction, the managerial staff should be clarified that the team would require access to documentation pertaining to every aspect of technology, and, where ever necessary copies of this documentation would have to be provided. This is necessary because the depth of thinking that has gone into the design of the processes may not be understandable to the assessors in the short duration of the Technology Audit which will be 3 days on an average.
  The identification of competitive factors and a consensus on the same must be reached during the preliminary managerial interaction.

- **Securing Overview of Operations**

  After the presentation, the audit team should secure the overview of operations with the help of the Management representative.

The team should look for specifically locating critical areas of operations that would have a definite bearing on the identified competitive factors. Unless explicitly cleared by the administrator, a maximum of 8 stages is to be identified including managerial approach. In the event of a doubt stages can be included and later on pruned to a total of eight.

- **Vertical and Horizontal Division of Industrial Operations**

For purposes of assessment it can be imagined that the entire operations are split into segments by slicing the organisation vertically and horizontally.

Along the horizontals, (Rows) the seven technology parameters, namely, Basic operational infrastructure, Product Technology, Process Technology, Skill & Knowledge base, Systems & Practices, Information support, and, Logistics & Optimisation level, are placed.

After a preliminary visit to the works, the columns are created out of crucial stages of manufacture / Operations.

- **Questionnaire for assessment**

Although a guiding set of questions have been prepared depending upon the specific characteristics of the stages in a given case, it may be wiser to review and recast these questions once the stages are identified. Wherever felt necessary the audit team may fabricate a separate set of guiding questions as per the advice of the Administrator. These questions are however to be used only to guide the data gathering and should never be used as standard questions for which answers will be furnished by the company representatives.

- **Interview with stage first line supervisor**

For each of the selected stages of operations, the first step is to interview the first line supervisor. The team should take an approach of learning while discussing issues with him. The team should not take an aggressive fault finding approach when anybody in the Organisation, not to say the least, with the first line supervisor is trying to present some information. The first-line supervisor is the link to understanding the operations and hence it is very essential to develop a good rapport with him. The opening question should be:

" We are strangers to your organisation and to your technology; please give us a quick over view of operations in your area including the

intricacies, the specialities, difficulties and the past problems, in respect of technology and operations".

Once the confidence of the supervisor is established the information called for in the audit can be secured.

- **CAPTECH KIT**
  Each of the assessors is provided with a **CAPTECH KIT** consisting of all the relevant papers cited in Annexure1 to annexure 4 including sub variants. The brief overview as explained by the supervisor should be recorded in the space marked ***"Brief Description of the stage"*** in the appropriate document. Assessors are advised not to exceed the space limit provided for the purpose. Assessors must develop the skill to record every vital point in this space and still not exceed space limits.

- **Assessment through study of operations**
  The team leader, (the CAPTECH administrator) will now request the line supervisor who may be called severally depending on the organisational practices, to guide the team through physical operations.
  The operations should be studied along with documentation available if any, at each of the stages. Emphasis should be given to understand the mechanism, which triggers the activity, the plan for operations as well as operating capacity. Planning is the most common weakness in SME'S. Every practice and the purpose behind the practice must be grasped during the floor visit to the stages.

- **Assessment through study of operations- useful tip**
  To assess the strength with respect to parameters in any stage / section of operations, first identify the "Product" of that stage / section. For example, while assessing a purchase department, their product is the "Purchase Order". The value addition to the operations is the generation of the Purchase Order.
  Now to assess the parameters,
  Consider the parameter:
  Basic Operational Infrastructure This would be the infrastructure required for generating a purchase order. Clearly it could be a software and computer support. It could be the support of clerical staff or typists. It could even be preformatted Purchase orders.

Consider the parameter:
Product Technology. This would be built in design features of the purchase order itself. For example it could be the type of purchase order depending on the category of the item being bought. It could be order for

- A Class Item
- B Class item
- Standing purchase order
- Order for Spare parts
- Order for capital equipment

Product technology assessment would assess the strength of the design of the purchase order with reference to these.

Consider the parameter:
Process Technology. This would be the methodology of generation of the purchase order and its follow up till receipt of goods.

Consider the parameter:
Skill & Knowledge base: This would be the assessment of the knowledge and awareness of Purchase methodology and how the efficiency of purchase would increase. For example if the purchase staff do not know what is vendor rating, it is a serious deficiency.

Consider the parameter:
Systems & Practices: This would be the assessment of the systems connected with purchase which will guarantee arrival of goods without causing shortages or high costs of procurement. The assessor should assess whether there exist procedures to compare performance of purchase with respect to EOQ levels for A class items. It could be assessment of system of reconciliation of deliveries.

Consider the parameter:
Information Support: This would be the assessment of the Information support to the purchase department in terms of imputed ordering costs, storage costs, shortage costs, lead time, latest governmental tariff regulations, on line information on stocks in stores, competitors' vendors etc.
Consider the parameter:

Logistics & Optimisation level: This would be the assessment of the logistics of indent for purchase. It could be computerised information support regarding latest vendor ratings being provided with dynamic evaluation through

software. It could also be provision to have standard purchase order terms & conditions. It could be assessment of on line email support for supplier communication. It could be a provision for dynamic monitoring of ABC, VED, FSN analysis. It could be an assessment of how purchase costs are maintained at most optimal levels.

- **Key factor recording**
  In most cases, the rating will be done on the basis of one vital information regarding strength or weakness. This factor/s which will largely decide the rating is called as key factor. This criteria or factor must be recorded under the head RESPONSES in the assessment space. This will provide the lead for why a rating is high or low. It will later assist in making specific recommendations.

- **Evaluator consensus**
  Each of the assessors will record the ratings independently. At the end of the evaluation of each stage the Administrator should conduct the assessment team to consensus on the ratings in the "assessors only" slot of the audit schedule, after listening to the logic of each of the team members.

- **Stage evaluation finalisation**
  At the end of every stage, the Administrator will have to finalise the evaluation on the basis of the agreed logic and the finalised ratings must be incorporated with corrections if necessary in every team member's CAPTECH KIT.

- **Implementation across stages**
  During audits of subsequent stages, it is possible that there will be cross linked functions between the stages which are better understood by a study of the stages with independent repeat floor visits of the audit team. This may some times lead to the revision of the ratings of the previous stages and if required it should be done so.

Managerial Approach

Managerial approach is a very critical area for SME's. The top management personnel vitally contribute to the performance of the organisation at all stages. However, Operations at the stages are evaluated in the methodology without linking it to the managerial performance at that stage. Hence Managerial Approach is to be separately evaluated as a distinct stage. The CAPTECH Administrator is to evaluate the managerial Approach through Top management meet to be conducted by the administrator.

The CAPTECH administrator has to conduct the evaluation of the managerial approach very skilfully. His approach should be one of facilitating the management to make them identify current deficiencies and think of better practices and methods of executing the operations rather than fault finding. This has to be done diplomatically as otherwise the management will tend to measure the maturity of the team to deliver advice to them.

The managerial appraisal is always done best in the end. This appraisal is done in a top management meeting to be conducted by the CAPTECH administrator. The focus in this meeting should be to obtain the approach of the management on the following issues:

- **Criterion 1 Managerial Vision**
  This is examined in terms of the management ability to see into the future. The issues to be examined are "*how the vision is consistent with the development of competition in the time to come.*" Vision should direct the company towards how to make tomorrow different from today.

- **Criterion 2 Business Mission**
  This issue is connected with establishing targets for promotion of Business and its sustenance and, working towards it. The growth plan for the company is to be built into its mission. The growth could be in terms of technology or in terms of volume of turnover. In short Mission could be setting forth what should be done today and how to ensure it is done today. Mission is a short term plan as compared to Vision which is a long term strategy.

- **Criterion 3 Scientific Orientation**
  The current environment and state of the art of technology is such that results cannot be achieved without recourse to structured and scientific orientation in all matters.
  When confronted with an issue, does the management face it with a scientific orientation?
  This is the issue being evaluated under this criterion.

- **Criterion 4 Company climate**

The HR ability of a company determines its performance. It is the ability to breed a good employee culture. Under this criteria the ability of the management to make the employees deliver their best is to be examined. With bad HR when potential of the human beings is 10 units the achievement will be 6; however, when HR is good, a potential of 10 will result in actual exceeding 10. The management should be quizzed to explain what is their modus operandi to achieve the best employee performance. The level of motivation of the workforce is evaluated under this criterion.

This is to be achieved through suggestion schemes, the use of Quality circles, Incentives, awards etc.

- **Criterion 5 Policy & Target Control**
  It is easier to state mission objectives rather than to achieve it. The achievement presumes the existence of a policy. The policy prescribes a frame work of operational principles with in which the target is to be achieved. Once the target is set there exists a necessity to monitor the target and harness controls to achieve the set targets. These issues are examined under this criterion number 5.

- **Criterion 6 Problem resolution**
  The task of management is not simple. The power or lack of power of the management will surface while solving a problem. There will be a repeated need to institute changes. Change management by itself is a problem. ***"How does the management deal with such situations?"*** is what is to be examined under this criterion. Effective decision making is at the centre of problem resolution. The assessors should examine how the management will resolve any problem in the past to assign ratings on this criterion.

- **Criterion 7 Implementation Mechanism.**
  Once decisions are taken, the implementation part becomes the crux of the process. Issues like "Who should bell the cat?" will repeatedly

bog the management echelons. Change implementation is a major skill that is wanted in all managers. These issues are to be examined and evaluated under this criterion.

A few vital leads are cited herein to assess the managerial approach.

Examining the following may be helpful in the assessment.

- ***Vision of MD / Chairman***
  The top man should be asked to spell out the vision of the company.

- ***Managerial Performance Criteria***
  Examining periodic performance review is another vital link to managerial appraisal. These reviews should be the responsibilities of the chief of operations in the areas of:
  Marketing
  Planning
  Production or manufacturing
  Quality & Customer liason
  Finance
  The existence of such review committees and the agenda content of the review committee meetings will reveal issues in relation to the above. These should be used for assessing criteria 2,4,5, 6 and 7

- **Market Share and Competitor Assessment**
  Examine whether the management is constantly reviewing the strategies of the competitor and his market share. This will enable evaluation against criteria 2, 4, and 5

- **Strategic Planning**
  A vision plan cannot be a success without a strategy. The mechanics of strategic planning will take the company to where they want to go. This should be used to assess the managerial approach against criteria 1,2 and 4

- **Plan for internal culture creation**

This would reflect the mechanism of generating employee commitment to organisational objectives. This would be reflected in the form of welfare measures, and other motivational approaches.
This should be used to assess criteria 3, 4, 6, and 7.

- **Analysis of External Factors**
  The way an organisation studies external factor effects on their business is very important for developing and working towards a business plan. Obviously this should be used to evaluate criterion 2

- **Financial performance Indicators**
  In the current scenario, accounting information is available on a live basis for instant observation. A company which has gone deep into computerisation must learn how to review their financial statements periodically with live updates on the system. Unfortunately, the process of identifying critical review ratios from financial statements is not aimed at in SME's and this carries a low priority for management appraisal. This trend must changed by creating an awareness of the utility of critical financial indicators. This is the mechanism for credit control, efficiency of handling debt, and also minimising working capital costs. For quite a number of SME's establishing cost centre controls is only a small step away. They must learn to do this and they should not shy away from this.
  The above issues are used to evaluate criteria 2,4, and 5.

- **Agenda for managerial review Meetings**
  Review meetings should focus on developmental and incremental efficiency increase oriented projects. Whereas, they are commonly centred around fire fighting agenda and fault-finding agenda. The proportion of the fire-fighting agenda to developmental agenda would become clear if the agenda of a few

review meetings are examined. This should be done to assess the ratings for managerial approach against criteria 1,2,3,4, and 5.

- **Capacity Vs Delivery control**
  Job order oriented industries must attempt to evaluate their capacities and improve their planning on the basis of stated capacities. The degree of awareness of capacities is most often subjective and past performance based. There is a necessity in such industries to take to the concept of capacity determination on the basis of Aggregate Planning concepts. There is also a need to scientifically arrive at delivery targets. Whether the management is accomplishing this is to be examined while assessing the managerial approach on criteria 4,5, and 7.

Consolidating The Swot Matrix.

Once all the stage evaluations are obtained, the consolidated SWOT MATRIX is obtained by consolidating all the evaluations. This is the base matrix to be furnished for the software to develop the analysis.

ASSESSING THE NORMALISING VECTOR

The Normalising Vector cited in page 30 is now to be decided upon.

In order to do this, the current strengths of the company are to be assessed in each of the Technology parameters. This would decide the magnitude of effort and inputs required for strengthening the component of technology.
To exemplify, consider a situation:
A LAN connecting the administration, management, and the floor operations supports Enterprise operations. However, let us assume that there is vital information-flow, which is missing. This may be because the software executives are aware of meddling with the UNIX based LAN but the Operational staff are not exposed to UNIX and do not find it comfortable to retrieve information from UNIX. The issue of updating information support in this situation is very simple. It only requires either substitution of the UNIX system with a Windows based LAN or training personnel in UNIX. These cost and effort is far minimal as compared to the cost and effort of obtaining plant and machinery with different operating capacity and features. If the Information support carries a vector component 1, the Basic Operational Infrastructure should carry 3 to signify that it is 3 times to update Basic Operational infrastructure.

In the same situation however, if there was no LAN system connecting Administration, Management and floor operations, it could probably be 2 for Information support and 3 for Basic Operational Infrastructure to facilitate installation of computers at vital locations.

Using the above concept the Normalising vector components for each of the 7 Technology parameters are to be chosen.

The Audit team will however only suggest and guide the management on the issue of choice of normalising vector. It is preferable to get a consensus on the choice of the normalising vector between the management and the Audit team.

THE CAPTECH TECHNOLOGY AUDIT REPORT

Once the above components are ready the computation and outline structure of the report can be generated.

Generating the Report

Stereo typed report formats have been already designed and there is no need to change the contents of the preliminary portions of the report. These portions are obtained by just entering the SWOT MATRIX data into the spreadsheet.

Generating the Options

On the basis of the ***prioritised action plan*** for gap recovery, the recovery options should be deduced by citing specific technology gaps in a manner that it is understandable to the management. The citation of the suggestions and recommendations is a job for a seasoned practitioner and should be generally done by the CAPTECH Administrator. The attributes expected in the Administrator and the Assessor are furnished elsewhere.

Linking Options to Priorities

Linking the Options to the competitive factors, it is necessary to classify each of the options in order of descending importance, into one of the three categories of actions namely,

- **STRAIGHT FORWARD OPTIONS**
- **REFORMATION OPTIONS**
- **STRATEGIC INVESTMENT AND TECHNOLOGY UPGRADATION OPTIONS**

This is to be done as per the criteria cited earlier (Please refer contents)

Presenting the Report

The report must be presented to the director of Owner of the enterprise if he or she is a technocrat. Alternatively it may be presented to whom so ever, the director decides. However, it is advisable to present the report with a briefing on the main observations.

FOLLOW-UP MOTIVATION

Guide lines for Understanding & Implementation

To facilitate follow up and implementation, along with the report, the guidelines for implementation is furnished to the company audited. This guideline is as per Appendix4

It is necessary to motivate the management into working on the basis of the report. This will be the only way to strengthen the organisation to face competition. This must be adequately clarified with an option for the management to call back the Administrator for further clarification if required.

INTERACTION, CLARIFICATION AND DEFENDING THE RECOMMENDATIONS

It is possible that the management does not see the points as logical and they may require clarifications. The audit team must take the responsibility to provide clarifications and to convince the management. There is no need to have any apprehensions about the methodology since the methodology is highly scientific and objective.

INDEX

REFERENCES

1. UN-ESCAP / APCTT — A framework for Technology Based Development Technology Atlas Project 1989

2. UNIDO / CEGESTI — Viability Study on the establishment of a Technology Management Centre in Kenya Rodriguez Javier & Alexander Van der Hoeven 1995

3. UNIDO / ICS Trieste — Guidelines on Technology Needs Identification in Small and Medium sized Enterprises 1998

4. UNIDO / ICS Trieste — Technology Management for leap-frogging Industrial Development 1998

5. UNIDO / ICS Trieste — TECCH – Technology, Environment, Competitiveness and Change Management 1998

ANNEXURES

TO MANUAL FOR CAPTECH THE UNIDO TECHNOLOGY AUDIT TOOL FOR TECHNOLOGY NEEDS ASSESSMENT OF SME'S

ANNEXURE 1 PARAMETER RANKING CRITERIA

Rank	1	2	3	4	5	6
Basic Operational Infrastructure	No Infrastructure	Crude Infrastructure	Outdated Infrastructure	Nominal Infrastructure	Good Infrastructure	Excellent Infrastructure
Product Technology	Fading Product	Launch stage Product	Mature Product	Same as 3 with proven results	Same as 3 with additional features	State of the Art Product
Process Technology	Orally informed Process	Documented process	Principal's Know how	Established Process with Know Why	Process with on line Controls	Same as 5 with Fuzzy logic dynamic corrections
Skill & Knowledge base	Down the lane skills	Experience with Marginal Technology content	Experience with assorted Technical Skills	Proven experience with competence	Same as 4 with Technical backing	Firm Technology backed specialists
Systems & Practices	No systems & Practices	Oral systems in certain instances	Documented systems at critical places	Documented systems with cursory checks	Wide ranging systems & Practices	Same as 5 with constant monitoring
Information Support	Data Lacking	Lack of outside data	Internally generated customer supported data	Objective Information	Objective information with manual reaction	System designed information & reaction support
Logistics & Optimisation Level	No Logistics	Low level logistics	Unscientific Logistics	Logistics without Optimisation	Logistics with crude optimisation	Logistics with derived optimisation
Default	Vulnerable	Unreliable	Weak	Average	Good	Strong

ANNEXURE 2

THE TECHNOLOGY AUDIT QUESTIONNAIRE

COMPANY PROFILE

(To be furnished by the company)

Name of the Company			
Address		Phone	
		Fax	
		E-mail	
Products Manufactured		Sector	
		Employee Strength * A/M E O	
Average Annual Sales by products	By Quantity	By Value	
Name of the Contact Person		ANY OTHER INFORMATION	
Name of the person to be interviewed			
Proposed date of Interview			

* Key:

A/M Administrative / Managerial
E Floor Executives
O Operational

ANNEXURE 3
(To be customised and executed by a Qualified Administrator)
Section A INPUT SYSTEMS

STAGE NO.	BRIEF DESCRIPTION OF STAGE

- **INPUT:**

INPUT SYSTEM ASSESSMENT

CRITERIA	RESPONSES	RATING
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 3 A
PART II
(To be executed by TECHNOLOGY MANAGEMENT SPECIALIST)
Section A INPUT SYSTEMS

STAGE NO.	**BRIEF DESCRIPTION OF STAGE**
	Goods Inwards & Vendor Control

TYPICAL INTERVIEWING CHECKLIST:

Main Question:

- *Please describe the salient features of your Vendor system.*
- *Do you use any packages to dynamically evaluate them?*
- *How good is your check on vendor process control?*
- *How often do you need reconciliation with your sub-contractors?*
- *What are the strong points of your goods Inwards practices & Stores Practices?*
- *Do you know your competitors suppliers?*
- *Explain your purchase process*

ASSESSMENT *INPUT SYSTEM ASSESSMENT*

CRITERIA	**RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 3 B
PART II
(To be executed by TECHNOLOGY MANAGEMENT SPECIALIST)
Section A INPUT SYSTEMS

STAGE NO.	BRIEF DESCRIPTION OF STAGE SUBCONTRACTING SYSTEM

Main Question:

- *Please describe the salient features of your Subcontracting system.*
- *Explain your MAKE – BUY decision Process?*
- *If you use customer supplied product, what is your mechanism for identifying onus on product performance.*
- *If semi-finished goods are further processed by subcontractors what are your operational controls on results?*
- *Do you insist on monitoring your subcontractors' process?*

INPUT SYSTEM ASSESSMENT

CRITERIA	RESPONSES	RATING
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 3 C
PART II
(To be executed by TECHNOLOGY MANAGEMENT SPECIALIST)
Section A INPUT SYSTEMS

STAGE NO.	**BRIEF DESCRIPTION OF STAGE**
	DESIGN & DEVELOPMENT

Main Question:

- *Please describe the salient features of your design system.*
- *How is your design evaluated?*
- *What is the R & D support to your design.*
- *Tell us about your software packages for design.*
- *What are your strengths of Prototype testing.*
- *Is there a connection between consumer complaints and Design Review?*

INPUT SYSTEM ASSESSMENT

CRITERIA	**RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 3 D

(To be executed by TECHNOLOGY MANAGEMENT SPECIALIST)

Section A INPUT SYSTEMS

STAGE NO.	BRIEF DESCRIPTION OF STAGE TOOL ROOM & TOOL CONTROL
.	

Main Question:

- *Please describe the salient features of your Tooling & Tool control.*
- *Is your tool room a separate cost centre?*
- *How are tool calibration processes implemented?*
- *How do you maintain the tool history for major tools?*
- *Do you use a calibration calendar & prevent use of uncalibrated tools in shop floor?*

INPUT SYSTEM ASSESSMENT

CRITERIA	RESPONSES	RATING
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 3 E

(To be executed by TECHNOLOGY MANAGEMENT SPECIALIST)

Section A INPUT SYSTEMS

STAGE NO.	BRIEF DESCRIPTION OF STAGE OPERATIONS PLANNING

Examine Main: *The Planning Mechanism*
Examine Aux.

- *Plan formats*
- *Order targets*
- *Routing and Job cards*
- *Idle time accounting*
- *Maintenance accounting*
- *Man power allocation*
- *Loading schedules reconciliation*

INPUT SYSTEM ASSESSMENT

CRITERIA	RESPONSES	RATING
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 4
PART B INTERMEDIATE TECHNOLOGY STAGE
(To be customised and executed by a Qualified Administrator)

STAGE NO.	BRIEF DESCRIPTION OF STAGE

TYPICAL INTERVIEWING CHECKLIST:

	ASSESSMENT	*INTERMEDIATE STAGE ASSESSMENT*
CRITERIA	**RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 4 A
PART B INTERMEDIATE TECHNOLOGY STAGE

STAGE NO.	BRIEF DESCRIPTION OF STAGE MACHINING

TYPICAL INTERVIEWING CHECKLIST:

- Please describe the critical manufacturing operations and controls you have at this stage
  - How strong is your Process Design and control?
  - Is your processing technology borrowed? Do You have a step by step know how? Along with know why?
  - Do you have an effective cycle time specification?
  - Is there a Written standard Practice for the operation?
  - How are the machining parameters designed for optimisation?

ASSESSMENT	*INTERMEDIATE STAGE ASSESSMENT*	
CRITERIA	**RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 4 B
PART B INTERMEDIATE TECHNOLOGY STAGE

STAGE NO. **BRIEF DESCRIPTION OF STAGE**
CHEMICAL PROCESSING / HEAT TREATMENT

TYPICAL INTERVIEWING CHECKLIST:

- critical manufacturing operations and controls you have at this stage
  - How strong is your Process Design and control?
  - Is your processing technology borrowed? Do You have a step by step know how? Along with know why?
  - How good is your instrumentation Calibration?
  - Is there a Written standard Practice for the operation?
  - Explain the disposal of output wastes from the process?
  - Explain the setup for the process?

ASSESSMENT *INTERMEDIATE STAGE ASSESSMENT*

CRITERIA	RESPONSES	RATING		
Basic Operational Infrastructure				
Product Technology				
Process Technology				
Skill & Knowledge base				
Systems & Practices				
Information Support				
Logistics & Optimisation Level				

ANNEXURE 4 C
INTERMEDIATE TECHNOLOGY STAGE

STAGE NO. **BRIEF DESCRIPTION OF STAGE**
ASSEMBLY OPERATIONS

TYPICAL INTERVIEWING CHECKLIST:

- critical manufacturing operations and controls you have at this stage
  - How are the workstations designed?
  - Is there a ready availability of templates to increase assembly speeds?
  - How good is the workplace design; What are the ergonomic features?
  - Is there a Written standard Practice for the operation?
  - What is the material handling between stations?
  - Explain Line Balancing?

ASSESSMENT *INTERMEDIATE STAGE ASSESSMENT*

CRITERIA	**RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 4 D
INTERMEDIATE TRANSFORMATION STAGE

STAGE NO.	BRIEF DESCRIPTION OF STAGE PROCESS

TYPICAL INTERVIEWING CHECKLIST:

- Please describe the critical manufacturing operations and controls you have at this stage
  - How strong is your Process Design and control?
  - Is your processing technology borrowed? Do You have a step by step know how? Along with know why?
  - Do you have an effective feedback system for control?
  - Do you encourage any practices of suggestion schemes?
  - Do you have QC Circle mechanisms?
  - Do you have any innovations to your credit?
  - Does your technical staff know the techniques such as KANBAN, KAIZEN, POKA-YOKE, QUANTITATIVE ANALYSIS etc?

ASSESSMENT *INTERMEDIATE STAGE ASSESSMENT*		
CRITERIA	**RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 5

OUTPUT STAGE OPERATIONS

(To be customised and executed by a Qualified Administrator)

STAGE NO.	BRIEF DESCRIPTION OF STAGE

TYPICAL INTERVIEWING CHECKLIST:

1.

2.

3.

4.

ASSESSMENT *INTERMEDIATE STAGE ASSESSMENT*

CRITERIA	RESPONSES	RATING		
Basic Operational Infrastructure				
Product Technology				
Process Technology				
Skill & Knowledge base				
Systems & Practices				
Information Support				
Logistics & Optimisation Level				

ANNEXURE 5A
OUTPUT STAGE OPERATIONS

STAGE NO.	BRIEF DESCRIPTION OF STAGE
	Final Inspection & Packing & Forwarding

TYPICAL INTERVIEWING CHECKLIST:

- Please describe your shipment and consumer complaint redress system.
  - What are your transit and handling controls and losses?
  - Do you conduct analysis on your consignment rejections?
  - Do you know the technical details of the customer's inspection?
  - Do you have discussions on technical causes of rejections with your customers and Post submission feedback.

ASSESSMENT **OUTPUT STAGE ASSESSMENT**

CRITERIA	RESPONSES	RATING		
Basic Operational Infrastructure				
Product Technology				
Process Technology				
Skill & Knowledge base				
Systems & Practices				
Information Support				
Logistics & Optimisation Level				

ANNEXURE 5B
OUTPUT STAGE OPERATIONS

STAGE NO.	BRIEF DESCRIPTION OF STAGE
	Shipment & Consumer redress system

TYPICAL INTERVIEWING CHECKLIST:

- Please describe your shipment and consumer complaint redress system.
  - What are your transit and handling controls and losses?
  - Do you conduct analysis on your consignment rejections?
  - Do you know the technical details of the customer's inspection?
  - Do you have discussions on technical causes of rejections with your customers and Post submission feedback.

ASSESSMENT **CRITERIA**	**OUTPUT STAGE ASSESSMENT RESPONSES**	**RATING**
Basic Operational Infrastructure		
Product Technology		
Process Technology		
Skill & Knowledge base		
Systems & Practices		
Information Support		
Logistics & Optimisation Level		

ANNEXURE 6
MANAGERIAL APPROACH

STAGE NO. **MANAGERIAL APPROACH**

TYPICAL INTERVIEWING CHECKLIST:

- How good is your application of scientific methods w.r.t Maintenance, R & D, Productivity control etc?
- Do you keep trying to beat your competitors? How successful have you been?
- Do you have strategic plans to define your vision?
- What is the mechanism for achieving your vision?
- Do you periodically update the capacities of your staff?
- Do you have a policy of evaluating your equipment and capabilities regularly?
- What % of your turnover is spent on R & D?
- What % of your time is lost in fire-fighting?
- What is your own classification of your management? Insensitive? Crisis Management? Reactive? Proactive?

COMPANY LEVEL ASSESSMENT

CRITERIA	RESPONSES	RATING
Managerial Vision		
Business Mission		
Scientific Orientation		
Company Climate		
Policy & Target Control		
Problem Resolution		
Implementation Mechanism		

ANNEXURE 7
AUDIT SUMMERY
FINAL ASSESSMENT **SWOT MATRIX**

CRITERIA FOR ASSESSMENT (Critical Parameter)	OPERATION STAGE 1			2			3			4			5			6			7			PARAMETERS FOR MANAGERIAL APPROACH
	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	
Basic Operational Infras	6	5	5	5	5	3	5	5	5	4	3	2	5	4	4	4	4	3	6	5	4	Managerial Vision
Product Technology	5	5	5	4	4	4	5	5	5	4	3	2	5	4	4	5	4	3	4	4	4	Company Climate
Process Technology	5	4	4	5	5	5		5	4	5	3	3	5	5	5	5	5	4	5	4	4	Policy & Traget Control
Skill & Knowledge Base	5	5	6	3	4	4	5	5	5	5	3	3	5	3	3	4	3	3	5	5	3	Implementation Mechanism
Systems & Practices	5	4	4	5	5	5	5	5	5	5	3	2	5	3	3	5	5	3	5	4	4	Consumer Receptivity
Information Support	3	2	2	4	5	5	3	3	3	2	2	2	4	4	4	2	3	4	4	3	2	Problem Handling
Logistics & Optimisatio	3	4	5	4	4	4	2	2	2	3	3	3	4	4	4	2	1	1	3	3	3	Scientific Orientation

STAGE KEY:	STAGE DEFINITIONS
1	Design & Prototype Testin
2	Customer Support
3	Electrical Circuit Design
4	Manufacturing & Planning
5	Sub-Assembly & Testing
6	Final Assembly & Testing
7	Managerial Approach

ANNEXURE 8

NORMALISED SWOT MATRIX — Company Index No. ZZZ

CRITERIA FOR ASSESSMENT (Critical Parameter)	OPERATION STAGE																					Normalising Vector
	1			2			3			4			5			6			7			
	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	
Basic Operational Infras	18	15	15	15	15	9	15	15	15	12	9	6	15	12	12	12	12	9	6	5	4	3
Product Technology	10	10	10	8	8	8	10	10	10	8	6	4	10	8	8	10	8	6	4	4	4	2
Process Technology	5	4	4	5	5	5	0	5	4	5	3	3	5	5	5	5	5	4	5	4	4	1
Skill & Knowledge Base	5	5	6	3	4	4	5	5	5	5	3	3	5	3	3	4	3	3	5	5	3	1
Systems & Practices	5	4	4	5	5	5	5	5	5	5	3	2	5	3	3	5	5	3	5	4	4	1
Information Support	6	4	4	8	10	10	6	6	6	4	4	4	8	8	8	4	6	8	4	3	2	2
Logistics & Optimisatio	9	12	15	12	12	12	6	6	6	9	9	9	12	12	12	6	3	3	3	3	3	3

STAGE KEY:	STAGE DEFINITIONS
1	Design & Prototype Testin
2	Customer Support
3	Electrical Circuit Design
4	Manufacturing & Planning
5	Sub-Assembly & Testing
6	Final Assembly & Testing
7	Managerial Approach

ANNEXURE 9

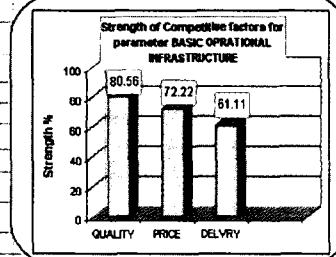
Part 1: PARAMETER-WISE ANALYSIS OF COMPETITIVE STRENGTHS

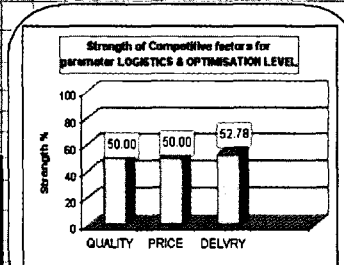
Part 1 PARAMETER-WISE ANALYSIS OF COMPETITIVE STRENGTHS

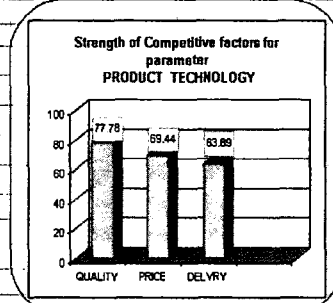
Company Index No. ZZZ

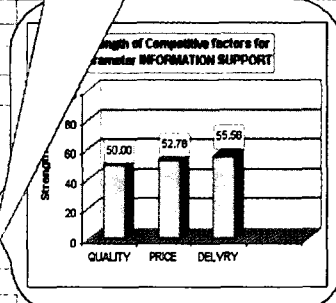
NORMALISED SWOT RATING MATRIX

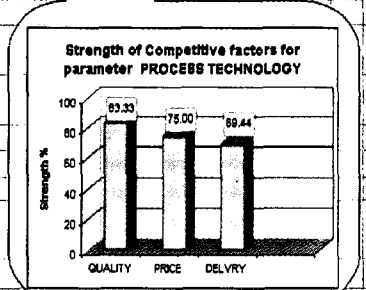
CRITERIA FOR ASSESSMENT (Critical Parameter)	OPERATION STAGE 1			2			3			4			5			6		
	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D
Basic Operational Infrast	18	15	15	15	15	9	15	15	15	12	9	6	15	12	12	12	12	9
Product Technology	10	10	10	8	8	8	10	10	10	8	6	4	10	8	8	10	8	6
Process Technology	5	4	4	5	5	5	0	5	4	5	3	3	5	5	5	5	5	4
Skill & Knowledge Base	5	5	6	3	4	4	5	5	5	5	3	3	5	3	3	4	3	3
Systems & Practices	5	4	4	5	5	5	5	5	5	5	3	2	5	3	3	5	5	3
Information Support	6	4	4	8	10	10	6	6	6	4	4	4	8	8	8	4	6	8
Logistics & Optimisation	9	12	15	12	12	12	6	6	6	9	9	9	12	12	12	6	3	3

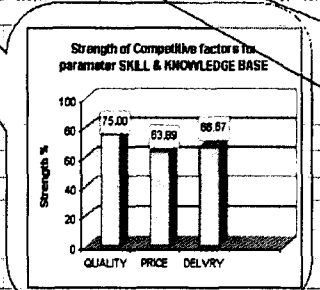


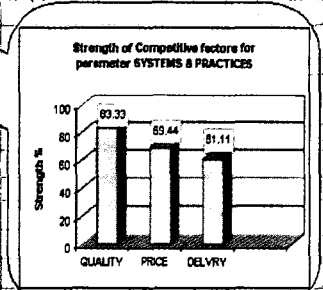






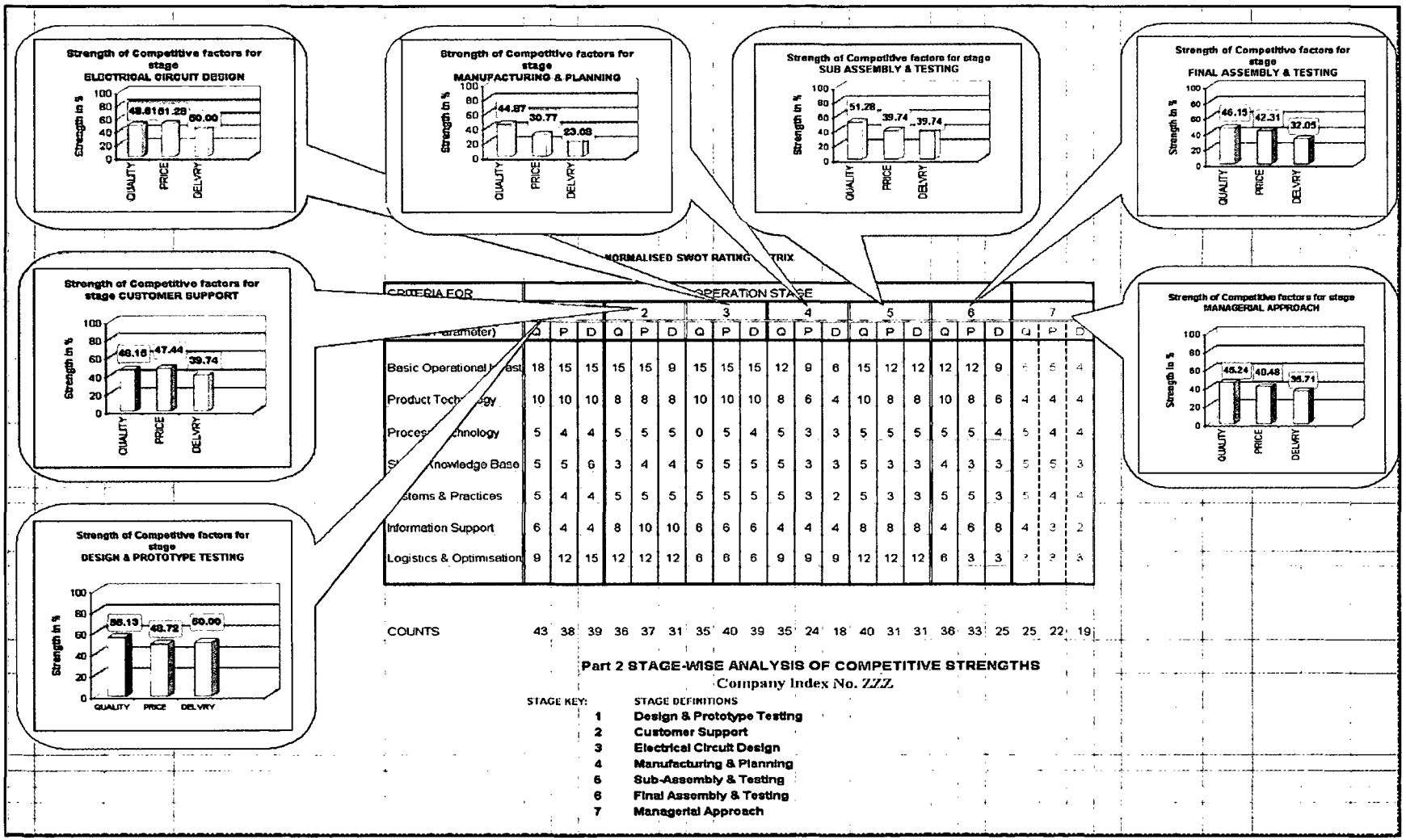






ANNEXURE 10

Part 2: STAGE-WISE ANALYSIS OF COMPETITIVE STRENGTHS



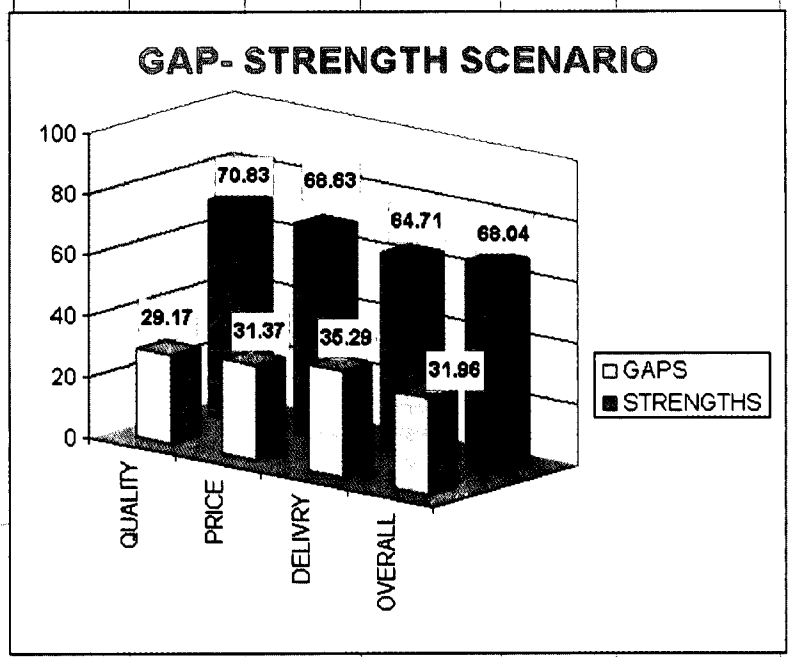
ANNEXURE 11
Part 3: ASSESSMENT OF OVERALL STRENGHTS

Part 3 ASSESSMENT OF OVERALL STRENGTHS

Company Index No. ZZZ

CALCULATIONS

COUNTS	357	350	330	1037
EXPECTATIONS	504	510	510	1524
	QUALITY	PRICE	DELIVRY	OVERALL
GAPS	29.17	31.37	35.29	31.96
STRENGTHS	70.83	68.63	64.71	68.04
	100	100	100	100



Annexure 12

Company Index No. IHA 00701032

Part 6 PRIORITISED ACTION PLAN

A: INDEXED TO PRICE **COMPETITIVENESS**

PRIORITY **GAP = 53.17 %**

1	M/C Dominant Operations (Units I & IV)	86.78 %
2	Information Support	73.81 %
3	Logistics & Optimisation Level	73.81 %
4	Manual Processing (Unit III)	63.79 %
5	Preparatory Process 2 (Unit II)	59.77 %
6	Systems & Practices	59.52 %
7	Pre dispatch Operations (Units III, I, & IV)	59.20 %
8	Managerial Approach	57.14 %
9	Process Technology	54.76 %
10	Primary Processing (Unit II)	54.02 %
11	Basic Operational Infrastructure	47.62 %
12	Preparatory Process 1 (Unit II)	46.98 %
13	Other Machining Operations (Unit III)	45.40 %
14	Product Technology	35.71 %
15	Skill & Knowledge Base	33.33 %

B: INDEXED TO QUALITY **COMPETITIVENESS**

PRIORITY **GAP = 51.83 %**

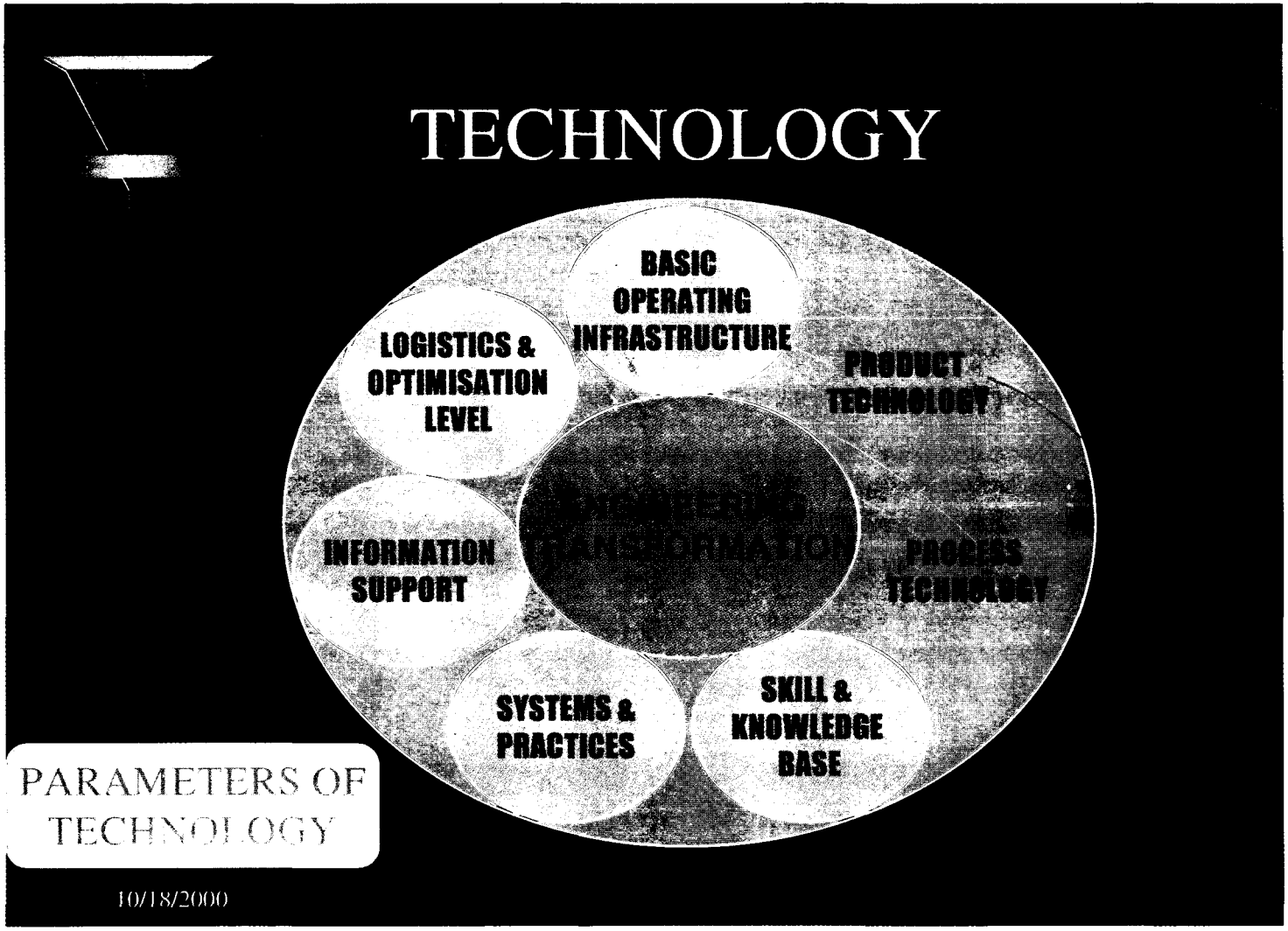
1	M/C Dominant Operations (Units I & IV)	86.21 %
2	Logistics & Optimisation Level	73.81 %
3	Information Support	69.05 %
4	Systems & Practices	61.90 %
5	Primary Processing (Unit II)	59.77 %
6	Manual Processing (Unit III)	57.47 %
7	Preparatory Process 2 (Unit II)	56.90 %
8	Pre dispatch Operations (Units III, I, & IV)	56.32 %
9	Process Technology	52.38 %
10	Managerial Approach	50.00 %
11	Preparatory Process 1 (Unit II)	48.85 %
12	Basic Operational Infrastructure	42.86 %
13	Other Machining Operations (Unit III)	41.95 %
14	Product Technology	38.10 %
15	Skill & Knowledge Base	35.71 %

C: INDEXED TO DELIVERY **COMPETITIVENESS**

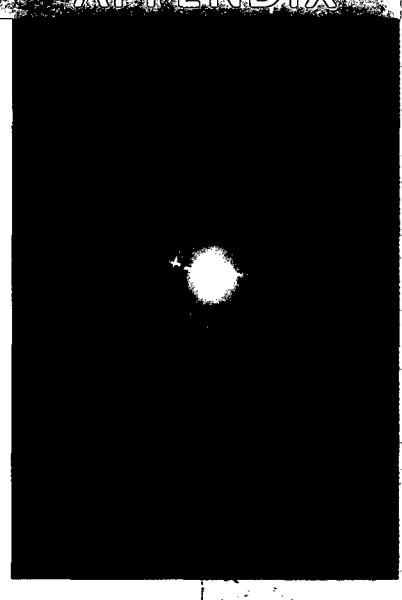
PRIORITY **GAP = 51.93 %**

1	M/C Dominant Operations (Units I & IV)	86.21 %
2	Information Support	71.43 %
3	Logistics & Optimisation Level	71.43 %
4	Manual Processing (Unit III)	61.49 %
5	Systems & Practices	59.52 %
6	Pre dispatch Operations (Units III, I, & IV)	59.20 %
7	Preparatory Process 2 (Unit II)	56.90 %
8	Managerial Approach	54.76 %
9	Process Technology	50.00 %
10	Primary Processing (Unit II)	47.13 %
11	Other Machining Operations (Unit III)	45.40 %
12	Basic Operational Infrastructure	45.24 %
13	Preparatory Process 1 (Unit II)	44.25 %
14	Product Technology	35.71 %
15	Skill & Knowledge Base	30.95 %

ANNEXURE 13


TECHNOLOGY
BASIC OPERATING INFRASTRUCTURE
LOGISTICS & OPTIMISATION LEVEL
PRODUCT TECHNOLOGY
INFORMATION SUPPORT
PROCESS TECHNOLOGY
SYSTEMS & PRACTICES
SKILL & KNOWLEDGE BASE
PARAMETERS OF TECHNOLOGY
10/18/2000

APPENDIX



TO MANUAL FOR CAPTECH THE UNIDO TECHNOLOGY AUDIT TOOL FOR TECHNOLOGY NEEDS ASSESSMENT OF SME'S

APPENDIX 1
MECHANISM FOR IDENTIFICATION OF COMPETITIVE FACTORS

Step 1: **Administer the questionnaire A** herein on each of your clients and obtain responses.

Step 2: **Identify areas of deficiency.**
A deficiency exists whenever the customers' criteria ranking is higher than the ranking secured by the company.

For example: Consider the response shown in **questionnaire A1.**

QUALITY
The Quality criteria ranking is 5 by the customer and the company ranking is 6. This implies that Quality is not an area of deficiency according to the customer XYZ Co.

PRICE
The customer criteria ranking is 4 and the company ranking is 1. Therefore there is a deficiency in price competitiveness. The deficiency score is (4-1) =3

DELIVERY
Since both rankings are 4, there is no deficiency.

Step 3: Find deficiency scores for each competitive factor.

The total deficiency score, including responses of all the customers is obtained for each of the competitive factors. For example consider the competitive factor "Quality":

DEFICIENCY SCORE FOR FACTOR QUALITY

Customer No.	Customer Criteria Ranking	Company Ranking	Deficiency score
1	5	6	-
2	5	2	3
3	6	5	1
4	3	3	0
...	#	#	#
TOTAL DEFICIENCY SCORE			4

Step 4: Identify the three factors, which have the top deficiency scores as the factors for the Technology Audit.

This is a guideline for your company to identify competitive factors relevant to you. If needed seek advice from the CAPTECH Administrator

QUESTIONNAIRE A

COMPETITIVE FACTOR IDENTIFICATION

CUSTOMER OPINION QUESTIONNAIRE

(Firms intending to examine their competitive strength may adapt this questionnaire.)

To

Sir,

As our valued customer, we would request you kindly to help us identify how we can serve you better by furnishing your answers to the questions here below:

(Please use a scale of 1 to 6 for your ranking criteria as follows:)

1. **Not important for us**
2. **Desirable for us**
3. **Considered as criteria**
4. **Important**
5. **Very important**
6. **Prime Consideration**

1 Poor
2 Reasonable
3 Satisfactory
4 Acceptable
5 Good
6 Exceptional

Rank your criteria for selection of suppliers Choose a rank between 1 & 6	FACTOR	Rank our company performance on these criteria
	Quality	
	Price	
	Delivery	
	After Sales Service	
	Co-operation	
	Flexibility	
	Aesthetics and Ergonomics	
	Environmental Considerations	
	Others (Please Specify)	

This is a guideline for your company to identify competitive factors relevant to you.
If needed seek advice from the CAPTECH Administrator

INTERPRETATIONS OF COMPETITIVE FACTORS

The competitive factors cited in this questionnaire will imply the following:

QUALITY
Conformance to specifications is today taken for granted. Quality is a factor taken beyond the concept of excellence, and it includes criteria of delight and criteria such as conveniences not imagined by customer, **CUSTOMER AMAZEMENT**

*"Quality shall include all those characteristics of the product by which it delivers the intended function while achieving **customer satisfaction** and deliver **customer delight** and shall also foresee what the customer did not foresee while specifying, it in the form of **Customer Amazement**".*
Quality will include reliability in the context of the Technology audit.

PRICE
Price is imagined in comparison to the value the product gives to the customer. It cannot be taken as the ruling market price of other products in the market without going into the value contained in the product.

"Price is defined as the integration of values contained in the product by virtue of the functions it performs, the satisfaction, delight and amazement the customer gets out of its usage across the life span of the product as translated in terms of money value by the customer".

DELIVERY
This criterion refers to the ability to hold on to delivery schedules without violating quantity norms prescribed. It is the ability to achieve deliveries without consideration of delivery reconciliation.

"Delivery competitiveness is defined as the ability of the company to achieve deliveries of the product or service as speedily as possible when a customer intend arises".

Delivery competitiveness is a function of the cycle time control of the company.

AFTER SALES SERVICE
This refers to after sales service and includes issues such as customer assistance in usage and maintenance, Warranty, Replacement, etc. It includes in-site assistance also.

CO-OPERATION

**This is a guideline for your company to identify competitive factors relevant to you.
If needed seek advice from the CAPTECH Administrator**

This refers to the service provided by the supplier in terms of human responses and assistance on issues. It does not include service provided in terms of Warranty,

Replacement etc. It will include order amendments, Technical Assistance, design and drawing amendments, delivery schedule deviations, extension of credit period and credit considerations. It also includes working together on test reports, Inspection and certification mechanism and such other issues where mutual informal consent is required.

FLEXIBILITY

This criterion refers to the need of the customer to provide for flexibility such as

- Product Customisation
- Variety
- Provision for design review
- Provision for reasonable order review

AESTHETICS AND ERGONOMICS

These are characteristics of the product by virtue of which it gives additional operational convenience to human beings while providing for appeal in terms of external human looks.

ENVIRONMENTAL CONSIDERATIONS

These are considerations involving the magnitude of environmental friendliness the product displays. The degree of contribution to environmental degradation is included in this factor.

This is a guideline for your company to identify competitive factors relevant to you. If needed seek advice from the CAPTECH Administrator

QUESTIONNAIRE A1
COMPETITIVE FACTOR IDENTIFICATION
CUSTOMER OPINION QUESTIONNAIRE

(Firms intending to examine their competitive strength may adapt this questionnaire.)

To M/s XYZ Co.
New Delhi

Sir,

As our valued customer, we would request you kindly to help us identify how we can serve you better by furnishing your answers to the questions here below:

(Please use a scale of 1 to 6 for your ranking criteria as follows:)

1. **Not important for us**
2. **Desirable for us**
3. **Considered as criteria**
4. **Important**
5. **Very important**
6. **Prime Consideration**

1 Poor
2 Reasonable
3 Satisfactory
4 Acceptable
5 Good
6 Exceptional

Rank your criteria for selection of suppliers Choose a rank between 1 & 6	FACTOR	Rank our company performance on these criteria
5	Quality	**6**
4	Price	**1**
4	Delivery	**4**
5	After Sales Service	**3**
	Co-operation	
	Flexibility	
	Aesthetics and Ergonomics	
	Environmental Considerations	
	Others (Please Specify)	

This is a guideline for your company to identify competitive factors relevant to you.
If needed seek advice from the CAPTECH Administrator

PROGRAMME FOR CAPTECH TECHNOLOGY AUDIT

STANDARD AUDIT PROGRAMME

PROGRAMME OUTLINE FOR

M/S

DAY & DATE	APPROPRIATE GROUP	PROGRAMME	REMARKS
Day1	Managerial / First line supervisory staff Assessors	Overview of purpose, Objectives and mechanism of Technology Audit **Time:**	• Enterprise overview • Audio Visual presentation of CAPTECH Audit Process through computer **Venue:** Discussion Room for strength up to 8 industry representatives including MD
	Management Representative & Audit Team	Conducted visit to Operations / shop floor (Overview of Operations) **Time:**	Visit to all sections
	Top Management & Audit team with Management Representative	Programme / Arrangement freeze for 3 days **Time:**	Meeting Company profile
	Stage 1 Executive / Representative	Stage 1 Audit **Time:** **Name of Stage:** **Time:** LUNCH	Interaction and Shop Floor visit
	Assessors only	Assessors Meet **Time:**	Meeting room
	Stage 2 Executive / Representative	Stage 2 Audit **Time:** **Name of Stage:**	Interaction and Shop Floor visit
	Assessors only	Assessors Meet **Time:** **Name of Stage:**	Meeting room

PROGRAMME FOR CAPTECH TECHNOLOGY AUDIT

DAY & DATE	APPROPRIATE GROUP	PROGRAMME	REMARKS
Day 2	Assessors with MD/GM	Progress Review **Time:**	Meeting room / MD room
	Stage 3 Executive / Representative	Stage 3 Audit **Time:** **Name of Stage:**	Interaction and Shop Floor visit
	Assessors only	Assessors Meet **Time:**	Meeting room
	Assessors only	Independent floor visits **Time:**	Shop floor
	Stage 4 Executive / Representative	Stage 4 Audit **Time:** **Name of Stage:**	Interaction and Shop Floor visit
		LUNCH **Time:**	
	Assessors only	Assessors Meet **Time:**	Meeting room
	Stage 5 Executive / Representative	Stage 5 Audit **Time:** **Name of Stage:**	Interaction and Shop Floor visit
	Assessors only	Assessors Meet **Time:**	Meeting room

PROGRAMME FOR CAPTECH TECHNOLOGY AUDIT

DAY & DATE	APPROPRIATE GROUP	PROGRAMME	REMARKS
Day 3	Assessors with MD/GM	Progress Review **Time:**	Meeting room / MD room
	Stage 6 Executive / Representative	Stage 6 Audit **Time:** **Name of Stage:**	Interaction and Shop Floor visit
	Assessors only	Assessors Meet **Time:**	Meeting room
	Assessors only	Independent floor visits **Time:**	Shop floor
		LUNCH	
	Time:		
	Stage 7 Executive / Representative	Stage 7 Audit **Time:** **Name of Stage:**	Interaction and Shop Floor visit
	Assessors & Management Review committee	Managerial Approach **Time:**	Interaction and Discussion and Presentations for Managerial thought
		FLOAT	
	Time:		
	Assessors & Management Representative	Report appraisal **Time:**	Meeting room

MAKE READY KIT FOR CAPTECH AUDIT
FORM1 STANDARD MERGE MAIL LETTER

Prof. J. GOVARDHAN
National Expert –Technology Management **December 19, 2001**

To
«Title»«FirstName»«LastName»
«JobTitle»
«Company»
«Address1»
«Address2»
«City» «State»
«PostalCode» «Country»
FAX: «Fax»

Dear «Title»«FirstName»«LastName»,

Sub: Proposed Technology Audit of your company

This is further to the telecon / your letter requesting for execution of a Technology Audit of your company to assess the strengths and weaknesses and hence to develop strategy for technology upgradation and gaining competitive edge.

Enclosed please find our CAPTECH flier, which enables your understanding of the mechanics of the methodology.

In order to facilitate planning for the Technology audit, you are required to comply with the following:

You are requested to furnish your company profile in the format given in annexure 2 along with your company catalogues, profile papers if any. The information furnished by you will be kept in strict confidence and is meant only to facilitate planning and execution of the Technology Audit.

Please note that you will have to identify three competitive factors on the basis of which the audit will be undertaken. To facilitate identification of the competitive factors you may use market diagnostics methodology given in appendix 1. It is presumed that you will be ready with identification of competitive factors before the arrival of the audit team.

Please also note that you will have to provide your vehicle or alternatively, bear the expenses connected with travel and local facilitation of the assessors numbering to three specialists.

The tentative dates for the proposed audit are «Schdate» subject to confirmation from our end.

You may furnish the name and contact particulars of an executive who will act as Management representative and who will facilitate planning, execution of the audit, and ensure access to the respective sections and provide appropriate data / records etc to the audit team.

You may get the confirmation of the audit programme over phone +91 11 6569779 from the undersigned after you have furnished the required information.

The tentative programme for the Audit is given in appendix 2
As per programme, it is proposed to present the CAPTECH tool to your executives /supervisory staff to facilitate a clear understanding of the job being undertaken and the purpose. The presentation will be made using a PowerPoint presentation, which can be handled, in an office providing space for the concerned staff to view a computer screen. If you do not have such a provision, you will have to inform us in advance and the presentation will be made through OHV.

You are advised to use the checklist given here below to ensure your preparedness for the audit.

Thanks & regards,

Prof. J. GOVARDHAN

CHECKLIST

Sl. No.	**Action required**	**Check here if ready**
1	Competitive factors identified?	
2	Company profile, catalogues, and literature sent to UNIDO?	
3	Management Representative Identified and informed to UNIDO?	
4	Travel arrangements for Audit team made?	
5	Provision for presentation of Technology Audit to executives/supervisory staff through computer made?	
	Alternative for 5 above ready?	
6	Scheduled dates Confirmed to UNIDO?	

Enclosures:
1. CAPTECH flier
2. Annexure 2
3. Appendix 1
4. Appendix 2

FORM 2 STANDARD MERGE MAIL SUPPORT DATA-BASE

FIELD STRUCTURE

Title	FirstName	LastName	JobTitle	Company	Address1	Address2	City	State	Postal Code	Country	Home Phone	WorkPhone	Fax	Sch date

APPENDIX 4

GUIDE LINES FOR UNDERSTANDING & IMPLEMENTATION OF THE CAPTECH REPORT

To facilitate implementation of the report, a task force must be formed first. This task force should involve vital executive staff of all departments. A Director or a representative of the entrepreneur should head the task force.

The following guidelines will help in studying the report and understanding implementation:

1. The Technology strengths of the company are furnished in Part 1 SWOT Matrix. Refer Annexure 7. The index numbers in this matrix indicate strength on a scale of 1 to 6 (1 for Weak and 6 for Strong). This is the base data on which all other information is generated through a variety of number crunching activities, which are not explained since they are unnecessary for practitioners.

2. The parameter wise analysis, Part 3 cited in annexure 9, enables understanding Technology strengths of the respective parameter for the chosen competitive criteria. Action to be taken on improving Technology parameter strength should be at the position where the given parameter is weakest.

3. Stage wise analysis, Part 4 cited in annexure 10, furnishes information on the strengths of the different stages of manufacture.

4. Prioritised action plan Part 6, cited in annexure 3, furnishes the list of priority actions to recover competitive strength in any identified competitive factor.

USE FOLLOWING MECHANICS TO IMPLEMENT THE REPORT:

5. To improve Technology strength with respect to parameters,
   - Study the Parameter wise strengths from annexure 9. For example, for parameter Process technology, Strengths are
     47.62 % on Quality, 45.24 % on Price and 50 % on Delivery.
     This implies gaps of
     52.38 % on Quality, 44.76 % on Price and 50 % on Delivery.

   - Decide on a strategy for technology upgradation. For example to operate on a strategy for improvement in Price Competitiveness first, look in the Normalised SWOT matrix(Also given in annexure 9), across the Process Technology row and the lowest numbers in Price. Clearly the choices are stage 3, 4 and 7 where the numbers are 8. (Ignore managerial Approach evaluations; they are to be tackled differently)

- Examine these stages in depth and attempt improvement

6. To improve Technology strength with respect to Stages of Operations,

   - Study the Stage wise strengths from annexure 1. For example, for Stage 3, Strengths are
     43.1% on Quality, 40.23 % on Price and 43.1% on Delivery.
     This implies gaps of
     56.9% on Quality, 59.77 % on Price and 56.9 % on Delivery.

   - Decide on a strategy for technology upgradation. For example to operate on a strategy for improvement in Delivery Competitiveness first, look in the Normalised SWOT matrix (Also given in annexure 10), along column 3 sub column D and the lowest numbers in Delivery. Clearly the choices are Information Support where the number is 2.

   - Examine the information that would speed up delivery time in stage 3 and take steps for the same.

7. The prioritised action plan has a total of elements equal to the Technology parameters (Ordinarily seven) plus the number of identified stages in the enterprise. For example, if 8 stages are identified for a company (Including Managerial Approach), there will be 7 + 8 = 15 priorities. These priorities are arranged from top to bottom in descending order of technological weakness with respect to each competitive factor. Study the mechanism of working with respect to a given priority as cited in item 9 here below for implementation.

8. To implement the report, choose the competitive criteria most important to you. The prioritised Action plan, i.e., part 6 of report, herein shown in Annexure 3, will help you in doing this. The competitive criterion against which the company is weakest is listed first in the Prioritised action plan. We feel that this criterion needs to be strengthened first unless other reasons exist.

   - To strengthen technology in the chosen competitive criterion, handle the first 3 or 4 priorities in the prioritised action plan. For example, if Quality is the competitive criterion for strengthening, examine, Machine Dominant Operations in Units I and IV, Technology Parameters Logistics and Optimisation level, Information support, and Systems and Practices. Attempt improvement in these.

9. The report also gives a set of recommendations. These recommendations are classified into 3 categories. They are:

   - Straight forward Options
   - Reformation Options, and
   - Strategic Investment options

The Implications of these options are explained in the Audit report. To improve Technology strength for any option, work on the listed priorities.

For example, consider the option given below:

The Design, Quality Control and Tool Room sections lack scientific support of precision measuring instruments.

Indexed by

Priority 1 & 6 on Price
Priority 1, 3, 4, & 7 on Quality

To implement this option,

Work on Priorities 1 & 6 on Price.
(Refer to prioritised Action Plan – Annexure 3)

Appropriate areas to be handled are
Machine Dominant Operations (Units I & IV),
and, Systems & Practices.

Work on Priorities 1 3, 4, and 7 on Quality
(Refer to prioritised Action Plan – Annexure 3)
Appropriate areas to be handled are
- Machine Dominant Operations (Units I & IV),
  Information Support,
  Systems & Practices, and
  Preparatory Process 2 (Unit II)

Using the above guidelines one can generate an action plan for every strategy identified by the company.

Not withstanding the above, entrepreneurs can get back to the administrator for further clarifications if any.

Annexure 7

PART 1 SWOT RATING MATRIX

Company Index No. IHA 00701082

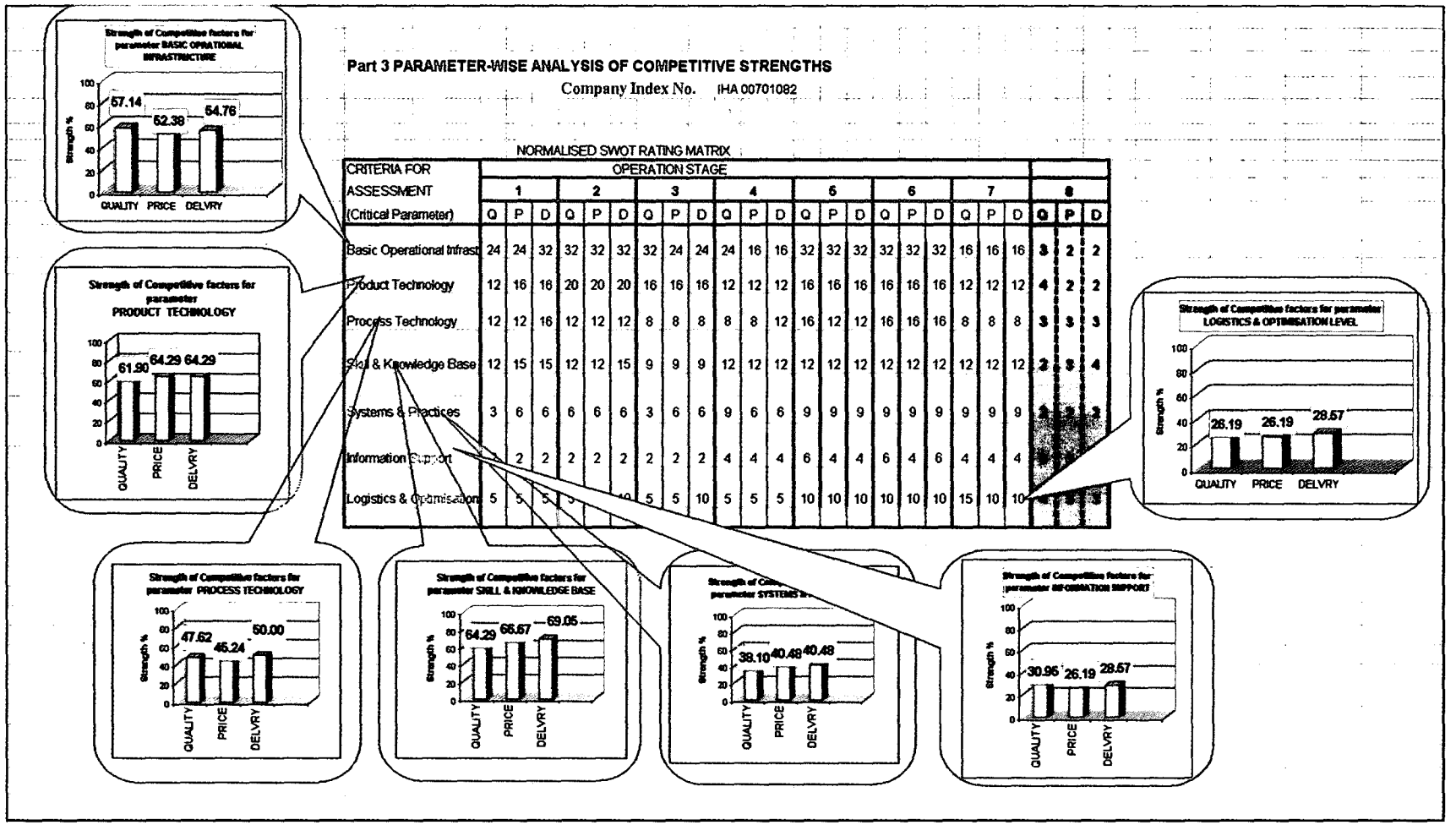
SWOT RATING MATRIX

CRITERIA FOR ASSESSMENT (Critical Parameter)	OPERATION STAGE 1			2			3			4			5			6			7			8			PARAMETERS FOR MANAGERIAL APPROACH
	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	Q	P	D	
Basic Operational Infra	3	3	4	4	4	4	4	3	3	3	2	2	4	4	4	4	4	4	2	2	2	3	2	2	Managerial Vision
Product Technology	3	4	4	5	5	5	4	4	4	3	3	3	4	4	4	4	4	4	3	3	3	4	2	2	Mission
Process Technology	3	3	4	3	3	3	2	2	2	2	2	3	4	3	3	4	4	4	2	2	2	3	3	3	Organistion Climate
Skill & Knowledge Bas	4	5	5	4	4	5	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	2	3	4	Policy & Traget Control
Systems & Practices	1	2	2	2	2	2	1	2	2	3	2	2	3	3	3	3	3	3	3	3	3	2	2	2	Scientific Approach
Information Support	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	3	2	3	2	2	2	3	3	3	Problem Resolution
Logistics & Optimisatio	1	1	1	1	2	2	1	1	2	1	1	1	2	2	2	2	2	2	3	2	2	4	3	3	Implementation

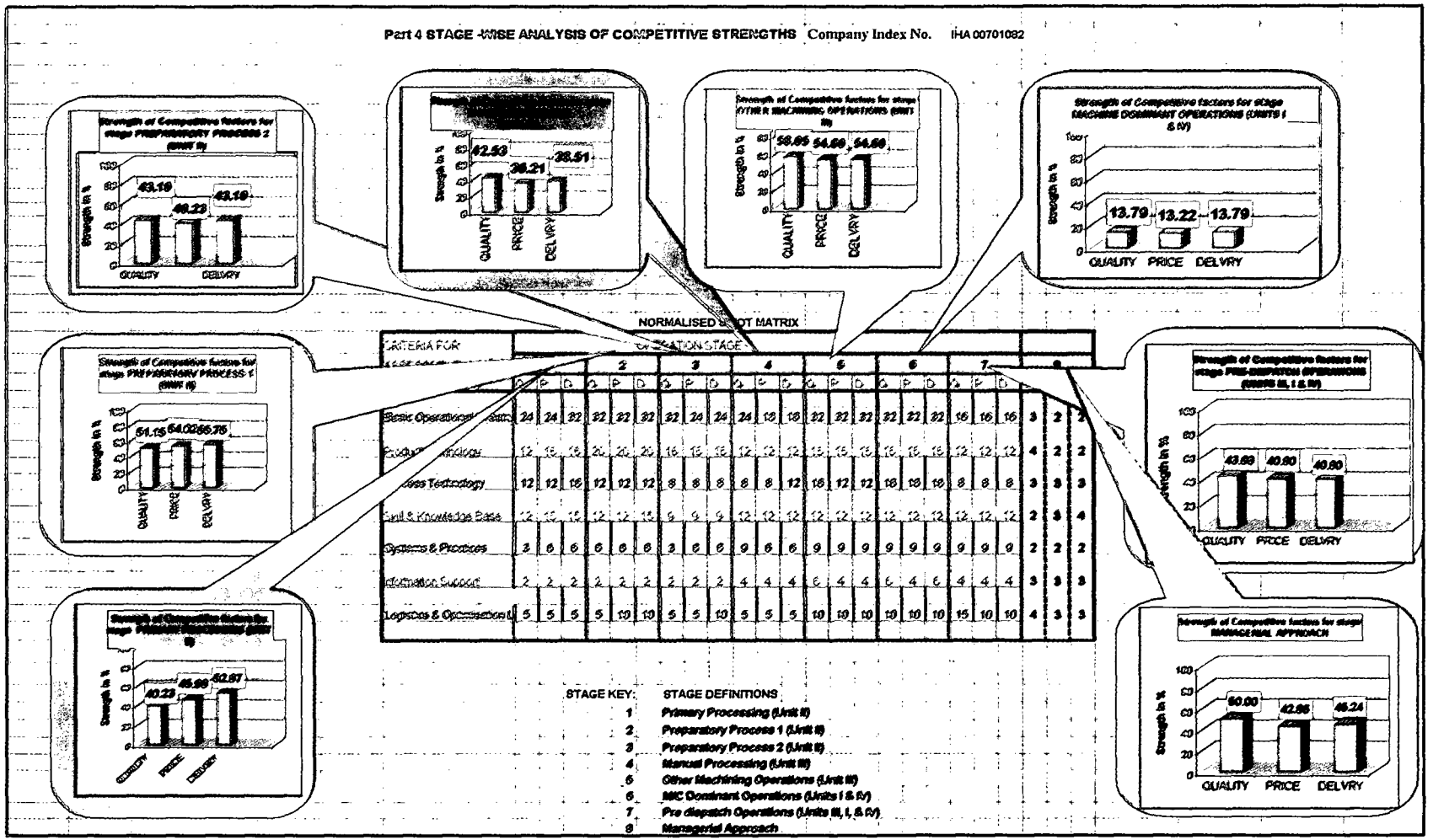
STAGE KEY: **STAGE DEFINITIONS**

1 **Primary Processing (Unit II)**
2 **Preparatory Process 1 (Unit II)**
3 **Preparatory Process 2 (Unit II)**
4 **Manual Processing (Unit III)**
5 **Other Machining Operations (Unit III)**
6 **M/C Dominant Operations (Units I & IV)**
7 **Pre dispatch Operations (Units III, I, & IV)**
8 **Managerial Approach**

Annexure 9


Part 3 PARAMETER-WISE ANALYSIS OF COMPETITIVE STRENGTHS
Company Index No. IHA 00701082
NORMALISED SWOT RATING MATRIX
CRITERIA FOR ASSESSMENT (Critical Parameter)
OPERATION STAGE
1 2 3 4 5 6 7 8
Q P D
Basic Operational Infrast 24 24 32 32 32 32 32 24 24 24 16 16 32 32 32 32 32 32 16 16 16 3 2 2
Product Technology 12 16 16 20 20 20 16 16 16 12 12 12 16 16 16 16 16 16 12 12 12 4 2 2
Process Technology 12 12 16 12 12 12 8 8 8 8 8 12 16 12 12 16 16 16 8 8 8 3 3 3
Skill & Knowledge Base 12 15 15 12 12 15 9 9 9 12 12 12 12 12 12 12 12 12 12 12 12 2 3 4
Systems & Practices 3 6 6 6 6 6 3 6 6 9 6 6 9 9 9 9 9 9 9 9 9 3 3 3
Information Support 2 2 2 2 2 2 2 2 4 4 4 6 4 4 6 4 6 4 4 4 3 3 3
Logistics & Optimisation 5 5 5 10 5 5 10 5 5 5 10 10 10 10 10 10 15 10 10 3 3 3
Strength of Competitive factors for parameter BASIC OPRATIONAL INFRASTRUCTURE
57.14 52.38 54.76
QUALITY PRICE DELVRY
Strength of Competitive factors for parameter PRODUCT TECHNOLOGY
61.90 64.29 64.29
QUALITY PRICE DELVRY
Strength of Competitive factors for parameter PROCESS TECHNOLOGY
47.62 45.24 50.00
QUALITY PRICE DELVRY
Strength of Competitive factors for parameter SKILL & KNOWLEDGE BASE
64.29 66.67 69.05
QUALITY PRICE DELVRY
38.10 40.48 40.48
QUALITY PRICE DELVRY
30.95 26.19 28.57
QUALITY PRICE DELVRY
Strength of Competitive factors for parameter LOGISTICS & OPTIMISATION LEVEL
26.19 26.19 28.57
QUALITY PRICE DELVRY

Annexure 10


Part 4 STAGE -WISE ANALYSIS OF COMPETITIVE STRENGTHS Company Index No. IHA 00701082
NORMALISED SHOT MATRIX
CRITERIA FOR
OPERATION STAGE
Basic Operational Features
Product Technology
Process Technology
Skill & Knowledge Base
Systems & Practices
Information Support
Logistics & Operational Linkages
STAGE KEY: STAGE DEFINITIONS
1 Primary Processing (Unit II)
2 Preparatory Process 1 (Unit II)
3 Preparatory Process 2 (Unit II)
4 Manual Processing (Unit III)
5 Other Machining Operations (Unit III)
6 MC Dominant Operations (Units I & IV)
7 Pre dispatch Operations (Units III, I, & IV)
8 Managerial Approach
QUALITY
PRICE
DELVRY

ANNEXURE 12
Part 6: PRIORITISED ACTION PLAN

Company Index No. IHA 00701082

Part 6 PRIORITISED ACTION PLAN

A: *(INDEXED TO PRICE COMPETITIVENESS)*

PRIORITY	GAP = 53.17 %	
1	M/C Dominant Operations (Units I & IV)	86.78 %
2	Information Support	73.81 %
3	Logistics & Optimisation Level	73.81 %
4	Manual Processing (Unit III)	63.79 %
5	Preparatory Process 2 (Unit II)	59.77 %
6	Systems & Practices	59.52 %
7	Pre dispatch Operations (Units III, I, & IV)	59.20 %
8	Managerial Approach	57.14 %
9	Process Technology	54.76 %
10	Primary Processing (Unit II)	54.02 %
11	Basic Operational Infrastructure	47.62 %
12	Preparatory Process 1 (Unit II)	45.98 %
13	Other Machining Operations (Unit III)	45.40 %
14	Product Technology	35.71 %
15	Skill & Knowledge Base	33.33 %

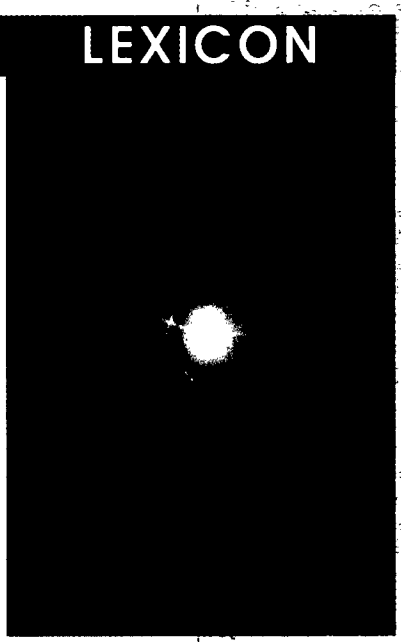
B: *(INDEXED TO QUALITY COMPETITIVENESS)*

PRIORITY	GAP = 51.83 %	
1	M/C Dominant Operations (Units I & IV)	86.21 %
2	Logistics & Optimisation Level	73.81 %
3	Information Support	69.05 %
4	Systems & Practices	61.90 %
5	Primary Processing (Unit II)	59.77 %
6	Manual Processing (Unit III)	57.47 %
7	Preparatory Process 2 (Unit II)	56.90 %
8	Pre dispatch Operations (Units III, I, & IV)	56.32 %
9	Process Technology	52.38 %
10	Managerial Approach	50.00 %
11	Preparatory Process 1 (Unit II)	48.85 %
12	Basic Operational Infrastructure	42.86 %
13	Other Machining Operations (Unit III)	41.95 %
14	Product Technology	38.10 %
15	Skill & Knowledge Base	35.71 %

C: *(INDEXED TO DELIVRY COMPETITIVENESS)*

PRIORITY	GAP = 51.03 %	
1	M/C Dominant Operations (Units I & IV)	86.21 %
2	Information Support	71.43 %
3	Logistics & Optimisation Level	71.43 %
4	Manual Processing (Unit III)	61.49 %
5	Systems & Practices	59.52 %
6	Pre dispatch Operations (Units III, I, & IV)	59.20 %
7	Preparatory Process 2 (Unit II)	56.90 %
8	Managerial Approach	54.76 %
9	Process Technology	50.00 %
10	Primary Processing (Unit II)	47.13 %
11	Other Machining Operations (Unit III)	45.40 %
12	Basic Operational Infrastructure	45.24 %
13	Preparatory Process 1 (Unit II)	44.25 %
14	Product Technology	35.71 %
15	Skill & Knowledge Base	30.95 %

LEXICON



CONTEXTUAL ADJUNCT TO MANUAL FOR CAPTECH THE UNIDO TECHNOLOGY AUDIT TOOL FOR TECHNOLOGY NEEDS ASSESSMENT OF SME'S

LEXICON

CONTEXTUAL ADJUNCT TO MANUAL FOR CAPTECH

(The unido technology audit tool
For technology needs assessment of SME's)

This lexicon is provided to help users of the CAPTECH manual to refer to the definitions of various terms used in the manual. The lexicon is furnished in alphabetical order.

ADMINISTRATOR (CAPTECH ADMINISTRATOR)

Any person duly trained by UNIDO or its authorised agency, to lead a team of assessors who will implement the UNIDO CAPTECH tool upon a given industry, and develop a SWOT matrix of the strengths of the company by bench marking or by assigning ratings to each of the competitive factors at each stage of manufacture or Operations and who will make the analysis of the strengths and furnish objective recommendations through an appropriate report and who can guide the industry in its implementation.

ASSESSOR (CAPTECH ASSESSOR)

Any person duly trained by UNIDO or its authorised agency, to undertake a Technology needs assessment of an Industry on the basis of the UNIDO CAPTECH tool by assigning ratings to each of the competitive factors at each stage of manufacture or Operations. He should be in possession of a Valid Certificate issued by UNIDO or any other authorised institution.

AESTHETICS AND ERGONOMICS

These are characteristics of a product or service which have a special value for the consumer.

Aesthetics are those characteristics by virtue of which the looks of the product appeal to the consumer and provide for his liking.
Ergonomics refers to those characteristics of the product by virtue of which it is designed to adapt itself to the user of the product conveniently. It enables the user to interact with the product more conveniently as compared to a product which does not have ergonomics built into it.

BENCH MARK

"A benchmark is an accepted best status of a product / product characteristic / process / Process characteristic in a given situation and for a company which is not at the ***Bench Mark*** *Level, provided working towards it is its objective". This best status arises out of the strengths with respect to the parameters of Technology.*

BUSINESS MISSION

This specifies the business objective of the company consisting of short term planning horizons. It includes

issues such as planned increases in operating capacities, credit policy, market expansion, diversification, change in the degree of automation, etc. It also includes financial issues corresponding to the above and planning for finance.

B2B SITUATION

This specifies a Business to Business context where in the Manufacturer / Supplier and the Consumer / Customer are both business entities in a Sell-Buy situation.

CAPTECH

*It is the acronym for **CAP**ital Investment Evaluation for **TECH**nology upgradation or **CAP**acity building for **TECH**nology absorption. It is the name of the UNIDO tool for Technology needs assessment.*

The purpose of the tool is to facilitate identification of Technology deficiencies in an Industry or service and hence logically establish Capital Investment decisions.

The CAPTECH tool also enables Capacity Building for technology absorption by identifying operational deficiencies, errors in technology application and identifying correct practices and also identifying inefficient and unproductive operations and systems.

The administration of the CAPTECH tool is done in the form of a Technology Audit. If a company builds on the CAPTECH report recommendations they will have built in systems, which will enable the company, to achieve a smooth transition to advanced technologies. In other words it builds in the capacity to absorb advanced technology.

COMPETITIVE FACTORS

Any factor, which forms the criteria for a customer to affect his purchase decision, is called Competitive Factor. Competitive factors are always external to the company.

DELIVERY COMPETITIVENESS

"Delivery competitiveness is defined as the ability of the company to achieve deliveries of the product or service as speedily as possible when a customer indent arises".

Delivery competitiveness is rated low whenever, the existing capacities are not translated into realisable results.

FIRE FIGHTING

This terminology refers to the effort of solving a problem on a "minimise damages for now", basis. Not withstanding the efficiency of all managers, every enterprise will face situations, which require fast remedies for problems detected during operations. It is the task of crisis management. Fire fighting basically arises out of a trigger initiated by a lapse in management at some point. While it cannot be disputed that fire fighting will be necessary in all situations, it should be the constant endeavour of a company to minimise these situations. In the constant effort towards fire fighting, management will loose sight of their vision and progress. The magnitude of the fire-fighting agenda in managerial review meetings is taken as a negative factor in evaluating managerial

approach. An efficient organisation should therefore have minimal fire fighting agenda in managerial time.

HOUSE KEEPING

"Activity involving existence of orderliness through assignment of specific places for specific things and regular verification to ensure Orderliness and updation of assignments."

INFORMATION

It is a crisp presentation of certain facts derived from the data in order to stimulate reactions and facilitate an appropriate managerial action or decision in respect of any activity.
It is distinctly different from data which is inanimate and does not animate any reactions triggering from it.

KEY FACTOR

This refers to the major criterion considered while assigning a rating for any given competitive factor at any given stage. The Key factor is recorded specifically in the CAPTECH KIT in the space provided for the purpose. This criteria shall override all other criteria in assigning the rating.

KNOW HOW

It is the knowledge of how to make a product in accordance with the technology furnished by the design engineer. It guides the operations of the company step by step along with stating ***do's and don'ts*** *in respect of operational practices and controls.*
Know how however does not furnish why a certain activity is done in a particular style. It does not furnish information about how the ***do's and don'ts*** *were established. Hence "Know How" does not help in trouble shooting. Also a "know how" is always subject to certain assumptions made during the time of the derivation of the "know how". What happens if these assumptions are not valid? This is a question which cannot be answered by the company with know how. In a way "know how" can be equated to Quack Technology and it does not provide firm control over results.*

KNOW WHY

This is knowledge about why a certain operation is done in a particular style. It also includes knowledge of "What happens if one does not perform the operation" in a particular style. Know Why is useful to develop own strategies of achieving results. It also facilitates easier handling during trouble shooting. It provides the necessary grips on the technology. Know why can also facilitate innovations and original core competency development.

LEAP FROGGING

This is a method of advancement of technology wherein a higher level technology is caught up without going through intermediate technologies to save time for advancement to a state of art.
While developments in any country could be leading to the same end results of technology, the time needed for stage-wise development is prohibitive. Developing countries cannot afford to go through all the stages to catch-up with the developed world. Therefore they should take recourse to leap frogging

for upgradation of Technology through venturing into the area of International Partnerships.

NORMALISING

This is a process of converting rating values for different parameters of technology at different stages of operations with respect to involved costs and complexities in order to facilitate prioritising actions of recommendations scientifically.

OPTIMISATION

"Optimisation is the task of deducing the best decision from among a set of choices which are completely exploratory with respect to all associated considerations."

PARAMETERS OF TECHNOLOGY

These are the constituent elements of any technology consisting of:

- *Basic Operational Infrastructre*
- *Product Technology*
- *Process Technology*
- *Skill and Knowledge base*
- *Systems & Practices*
- *Information Support*
- *Logistics and Optimisation Level.*

The strength of any technology towards competition arises out of the strength in these parameters.

PRICE COMPETITIVENESS

"Price is defined as the integration of values contained in the product by virtue of the functions it performs, the satisfaction, delight and amazement the customer gets out of its usage across the life span of the product as translated in terms of money value by the customer".

Price competitiveness is competitiveness arising out of the strength in pricing.

PRODUCT DEVELOPMENT

Product Development is the activity of converting a technically viable product into a revenue earning proposition through commercially exploiting the technology for industrial operations for making profitable business.

PRODUCT LIFE CYCLE

It is the period of time over which a product will possess market share at profitable levels in order to facilitate continued business opportunity to the possessor of the Product Technology. It is characterised by two distinct zones of the technology life cycle namely,

C: Launch and Commercialisation

D: Sustained marketing & business operations

(Refer figure on page 2 Main Manual)

QUALITY COMPETITIVENESS

"Quality shall include all those characteristics of the product by which it delivers the intended function while achieving ***customer satisfaction*** *and deliver* ***customer delight*** *and shall also foresee what the customer did not foresee while specifying, it in the form of* ***Customer Amazement****". Quality will include reliability in the context of the Technology audit.*

Quality competitiveness is the strength of the company arising out

of Quality of the product or service delivered by it.

REFORMATION OPTIONS

This is a category of recommendations of the Technology audit. These recommendations involve a thorough reformation of the way the operations are carried out. They therefore involve significant expenditure and large-scale changes in operational practices. The may be issues such as taking recourse to cellular manufacture, Change in layout, Prioritisation of orders and execution of production. They are also likely to require elaborate training of personnel. The operational culture of the company will change when such options are implemented.

STRAIGHT FORWARD OPTIONS

This is one of types of recommendations generated out of the process of Technology needs assessment. These are options for updating / correction of operations where a simple managerial implementation is required. The magnitude of monetary involvement is marginal. The lead-time to implement the recommendations is short. These recommendations arise out of handicaps which could also be due to managerial errors in operations.

SWOT ANALYSIS

"An analysis done by evaluating Strengths, Weaknesses, Opportunities and Threats of any system / Product."

TECHNOLOGY

Technology includes all the inputs required to convert an Engineering idea into a product which can fetch revenues from business; therefore Technology is a combination of ***Basic operational infrastructure****, Product Engineering described as* ***Product Technology*** *which is responsible for the market demand, Process control elements described as* ***Process Technology*** *which accounts for right delivery in large proportions, the human inputs of* ***skill and knowledge base*** *required for operation, the* ***information support*** *to make the conversion efficient, the* ***systems and practices*** *which make the conversion process fool proof, the* ***Logistics & Optimisation level*** *which provide for productivity, ease and efficiency of operation, and the wisdom of* ***managerial Approach*** *which will ensure sustenance of business.*

TECHNOLOGY ASSESSMENT

"Technology Assessment is the assessment of the strength of a company in the different Technology parameters".

TECHNOLOGY NEED

"The deficiency in the strength of a technology parameter in a company is the Technology need."

TECHNOLOGY LIFE CYCLE

It is the period of time over which a technology possesses marketable life. It is characterised by 4 distinct zones titled as:
A: Product Conceptualisation

B: Design and Prototype Development
C: Launch & Commercialisation
D: Sustained marketing & business operations

TECHNOLOGY PARAMETERS

*"The set of parameters which are **internal to a company** and which constitute the Technology are called Technology parameters".*

WORK INSTRUCTION

It is a set of stepwise instructions prepared either in the form of a table or a drawing which is provided to the shop floor personnel to facilitate execution of a given job in steps leading to completion.

WORK SYSTEM

"A scientifically designed system of execution of work citing specific responsibilities and inter-relationships between work groups such as isolating responsibilities for production personnel and Quality Personnel."

WRITTEN STANDARD PRACTICE

"An explicit document citing the different steps of execution of a given job / work scientifically designed to guarantee specific characteristics of output"