The Wholesome Quality
Transfer of Technology

Prelude:

In its simple definition technology means a core-knowledge pertaining to any field of business, enabling us to apply that knowledge for the efficient operation of the business. Generally, it also implies that we will be independently, operating that business system in due course of time in the buyer-supplier chain.

2. Take an example of the farmer who sells a buffalo to another person. While the deal is in progress, the seller will talk a lot good about her lactation superiority, her age, and left-over period of calf-producing age.

3. Usually any buyer would be content with these three pieces of information. The buffalo is then transferred to a new owner against a price. Did the seller transfer the complete knowledge really? If the buyer has problem with the eating pattern of buffalo which causes her to reject what is being offered to the rest of the buffalos in the barn, the seller has failed to transfer the core-knowledge.

4. Different types of fodders have different tastes and the seller’s buffalo was on fodder-I. While the buyer could afford fodder-II! What we are exemplifying here is the deliberate attempt to withhold a portion of knowledge so that after-sales retain some control on the buyer. Here you don’t disseminate full knowledge. So the knowledge or technology has not been transferred. The buyer dependency on seller continues throughout the life-cycle of the acquired system.

5. When we relate the business system to higher level goods and materials, like; Machining Centers, Aero planes, Jet Engines Etc., the “Knowledge” issue or the “Technology” governing the unhindered production of the system is not truly “transferred” to the Buyer. He continues to be dependent on Seller way beyond the acquisition date! Is this really intentional on the part of Seller? The answer is no as for as the spare parts support is concerned. But yes, when you create indigenous ways and means of reducing this dependency along the life-cycle of the system. Regulatory approval clauses would be invoked to deter you from setting the boundary limit of the dependence. Safety approvals will be withdrawn to deny us getting the full design potentials of the acquired system.

6. One could say that proper training was provided to the team of technologists of Buyer, spares also given, manuals delivered; so the technology is “transferred”! If the Seller does not enable us to reach the total independence, we are put into catch perpetually. Hence the transfer of technology (TOT) is denied.

Definition and Purpose of Wholesome Quality ToT:

7. At its simplest level Quality answers two questions: a) what is wanted? & b) How do we do it? When we look at the entire ToT process as practiced, we would notice that not enough is done about what we want nor know how to do it. The acquisition of product or service system from well-established enterprises (Seller) enabling the contracting team (Buyer) to run their programmed businesses independently in reasonable time frame, should be the fundamental spirit of ToT. The purpose or goal of any ToT should be to transfer the core-knowledge in an agreed manner to the buyer covering all aspects of manpower training, spare-parts support. And if the later starts producing the products or services satisfying the requirement of competitive price, consistent quality and delivery schedules, the Seller should facilitate entering the market of his territory too! This is almost a utopia.
Factors Influencing ToT:

8. Several factors influence the ToT form and shape in which the buyer identifies his success. These are:

a) **Prior Awareness**: The degree and extent of prior knowledge about the equipment or system being acquired constitutes awareness. If a very high level of existing knowledge is well geared & put to effective use, the ability to negotiate ToT on the part of buyer will be favorable. The newly acquired system will have minimum bottlenecks to operate and contribute towards the economic performance of the enterprise.

b) **Government Support**: When the Seller recognizes the determination on the part of the government buying the new equipment materials or systems, the shape of the ToT can’t be distorted easily. Often, the Buyer fails to muster sufficient government support for the transfer of technology mainly due to lack of sincerity on the part of government. When the Seller notices vested interest in the negotiation process, he hides the real knowledge for transfer. Distortion of the spirit of ToT results and the Seller successfully deviates from the initial commitments. Kickbacks and other shoddy practices in government support-system impair the Buyer to stay real on the true acquisition.

c) **Ability of Knowledge Absorption**: If the track record of the enterprise acquiring ToT is high, Seller will be less aggressive to hide what is paramount for the ultimate success. Past successful indigenization efforts and the market share will speak louder than the attempts to side-track the spirit of ToT.

9. Other pertinent factors thwarting any successful transfer of technology may be:

a) Lack of suitable culture
b) Absence of long term plans
c) Inadequate resources
d) Non-existence of technical groups
e) Limited financial resources
f) Participation of private sector in jeopardy

10. In the developing countries the problem of ToT is further compounded by issues relating to:

a) Absence of infrastructure
b) Trained manpower not obtainable locally due to poor education & training standards
c) Sanctions
d) Bureaucratic hindrances
e) Project Management deficiencies
f) Changing global security concerns
g) Contract formulation

**Elements of the Successful ToT:**

11. Since it is difficult to determine the cost of knowledge, it is therefore difficult to measure the cost of a successful ToT. Yet we can do a lot to clear our vision of the cost of knowledge. One of the known but less efficiently practical methods is the preparation of feasibility. An effective way would be to look at success stories of enterprises that got the ToT with minimum pains. Prepare the report i.e. the feasibility study based on the knowledge of the successful companies. Once that is ready discuss bottom-up the basis of your feasibility study and relate it to the profitability/growth of the organization in the long-term.
12. Carefully involve the local ToT team which has prepared the feasibility report, in the system acquisition. Study the terms and conditions mentioned by the Seller thoroughly, covering:

a) Joint Ventures
b) Technical Assistance and Know-how agreement
c) License Agreements
d) Working Together
e) Patent & Trade Mark Agreements
f) Turnkey Agreements
g) Intellectual Property rights and the extent up to which the Seller can provide excess

Offset Agreement:
13. The most commercially viable practice invoke across the globe is the ToT tool of the Offset Agreement. Offsets are contracts that require the Seller to transfer extra economic benefits to the buyer as a condition for the sale of goods and services. In many instances, governments prefer to realize those benefits in the form of in-kind transfer instead of bargaining for price discounts. Offset has emerged as an increasingly popular tool of government procurement. But this tool can also be utilized by the private sector with supporting attitude of the government. Common in exchanges involving aerospace goods and services, offsets permeate the market for defense system and weapons. Offsets often appear under the guise of

a) Compensation Packages
b) Industrial Benefits Programs
c) Cooperative Agreements
d) Countertrade Policy

Why Offsets?
14. As a large buyer the government has bargaining power that allows it to extract rents from Seller earning supernormal profits. The offset calls for the Seller to transfer some from of economic activity to the buyer’s domestic economy.

Types of Offsets as Tools of ToT:
15. When the procurement embodies high technology like purchase of Boeing-777 for PIA, it is important to obtain more information before deciding upon offsets. The decision whether to employ direct offset or an indirect offset is a function of the company’s objectives. If the company uses the instrument largely to safeguard its core competency and to enhance that competency to become self-reliant, Direct Offset is preferred. On the other hand, if the company views the offsets as an economic development strategy at government level, that aids capability acquisition, market penetration, or the reduction of information barriers, an Indirect Offset is better due to its wide applicability.

A Generic ToT Model:
16. In all the ToT challenges, we have Buyer and Supplier in the loop. The Buyer has the Real Spirit (RS) while the Supplier represents Real Issues (RI). Buyers’ organization is seeking technology transfer in a manner with minimum hurdles (obstacles) from the Supplier. This is a two-way communication, intense and full of excitement. Organizations where substantial money is invested in the transfer of the technology whether for the upgradation of the existing system or acquiring new, expect a good return with future independence. Technology suppliers while aligning with the goals of the organization don’t see the need to transfer it the way organization expects. This is almost a catch to understand so that we optimally stay satisfied in implementing the ToT. The diagram illustrated below depicts various RS &RI features.
17. The real spirit of the ToT should be to let the organization attain the economic development with minimum or nil dependence throughout the life cycle of the acquired system from the supplier providing the technology. We assert that organizations’ expectations should be evaluated in the light of difficulties as existing which are aught to be removed. Those are:-

a) Government policies/ Bureaucratic impediments  
b) Poor Maintenance Support-system invoke  
c) Poor Communication  
d) Hazy Project Management Plan

18. In the very early stage of negotiations we assume that a very good homework by buyer in identifying his difficulties coupled with remedial actions is done. The buyer is also expected to build a very high degree of professional knowledge about the system being acquired from the Seller who too has a few concerns to set the course for a true transfer. Those are:-

a) Inadequate capability/capacity assessment of the buyer’s existing facilities  
b) Strength of the political will of the Buyer  
c) The payment schedules relating to the cost of sales of the inventory under procurement  

19. The initial state of the TOT model is depicted at Fig#1. The type, shape or form of transfer mechanism needed in the TOT context, is influenced by these factors faced both by A, the Buyer & B; the Seller. So A &B are a distance apart on the transfer scale as shown. Ideally, we would like to have A &B as depicted by
20. But for the organization seeking TOT from the Seller, it is important to do the best evaluation of its Maturity Grid. This grid identifies the strengths of the Buyer to absorb the transfer. On the MG, if the Buyer aligned as shown below

![Fig#2 (Working Together)](image)

<table>
<thead>
<tr>
<th>Weak</th>
<th>5</th>
<th>Strong</th>
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</thead>
<tbody>
<tr>
<td><strong>Strategy (S)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Make-to-order</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>(ii) Limited customer base</td>
<td>b</td>
<td>b</td>
</tr>
<tr>
<td>(iii) Loyalty Focused</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>(iv) Repeat-order dependent</td>
<td></td>
<td></td>
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<tr>
<td><strong>Structure (S1)</strong></td>
<td></td>
<td></td>
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<tr>
<td>(i) Dedicated machines</td>
<td></td>
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<tr>
<td>(ii) Quick changeover</td>
<td></td>
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<tr>
<td>(iii) Dependable Supply Chain</td>
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<tr>
<td>(iv) Efficiently interactive</td>
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<tr>
<td><strong>Workforce Capability (WC)</strong></td>
<td></td>
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<tr>
<td>(i) Cross trained</td>
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<tr>
<td>(ii) Knowledge-based</td>
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<td>(iii) Traditional</td>
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<td>(iv) Life-time employment</td>
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**Fig # 3 (MATURITY GRID)**

21. If the Buyer A can see himself accurately aligned like abc on the MG, he is in a standalone state X. He can then ask the Seller to transfer the technology to the extent that during the short-term; say five years for major capital-intensive projects, he attains position a,b1,c1,. Here, we must remember that Buyer has to be very smart on strategy. He must adopt the strategy appropriate to the “limited customer base” in case of Defense products system under acquisition, and “Repeat order Dependency” for say, Auto-Industry procurement. If we assume Buyer A to be strong on strategy scoring position “a” at; about 8 on 1 to 10 strategy-line scale, position “b” i.e., about 5.5 on 1 to 10 Structure-line scale, and position “c” i.e., about 3.8 on 1 to 10 Workforce Capability-line, the Buyer is “aligned”. There is on kink. The kink is disruptive for the transfer process.

22. As we will see in Fig#3, the standalone position (x) of the Buyer (A) can only move to transferred position (Y) in the short term if adequate preparations are made ahead of transferring mechanism to
rejuvenate the existing structure \( S_1 \) so that “b” shifts to “b₁” on the MG appropriately. This may in practical terms mean, that Buyer (A) or, the organization seeking transfer is investing into constructing a new indigenous capability to welcome the technology. This may be a Class-100 Clean Room to test & assemble locally the LRUs required by the plant throughout the life-cycle of the Capital Equipment!

23. Simultaneously, Buyer (A) is expected to induct new knowledge-based people, get them trained so that existing position “C” shifts to “C₁”. Only when a,b,c is attained shall the Buyer (A) be categorized as aligned on the MG. and this is a continuous exercise. Unfortunately, most TOT efforts just finish off as jargon because no attempt is made to see the TOT at its grass-root! We hardly know of the tool of Maturity Grid in conducting self-evaluation before we grip the whip to transfer technology in our premises.

24. A deep look at Figure # 3 will tell us yet another alignment a₁, b₂, c₂! What does that mean? It says that the WORKING TOGETHER (i.e.; Buyer and Supplier) or Seller congruency is not unattainable. The organization continually looks for local-component in the transfer mechanism i.e., the vendor and willingly reshapes the strategy of welcoming others for synergy. That will make him move from “a” to “a₁”, “b₁” to “b₂” and “c₁” to “c₂”, respectively in the long term! Kinks or misalignment indicates that transfer of the technology was any thing but smooth and so the state of dependency will persist.

**Idealism:**

25. The ongoing discussion on TOT is quite theoretical though not without clarity. The Maturity Grid concept is very helpful to make us understand the underlying factors as to why TOT does not take place as we wish it to be.

![Fig # 4 (MG – Simple)](image)

Depending upon the type of technology in the short-term a buyer was well aligned on the MG as abc, but his enthusiasm evaporated overtime and his trained workforce moved out, deflecting him to position abc₁. So the dependency on the Suppler will return. In another case as also shown in Figure # 4, the organization seeking TOT is well-placed on the MG with extremely adoptable strategy \( S \) and a nice structure \( S₁ \) but very poorly equipped Workforce Capability (WC) such as a₁, b₁, c₂. The transfer system is not aligned for the desired TOT to take place. In both of these states willingness to transfer technology on the part of the Suppler is affected.

26. Transfer of technology (TOT) is on aif repeated term offered by the Seller; we negotiate and purchase capital equipment from. It is a very significant tool of success if properly applied. Experience with Military
hardware purchase however suggests that TOT had seldom been structured for the true advantage of the Buyer. There are several reasons to it.

   a) **Monopoly:** When the Seller notices limited options of the Buyer, he capitalizes on jargons. He applies tricks of the trade rather then the trade. He procrastinates deliberately to let the Buyer run out of patience. Then he dictates his terms. Since that situation becomes almost desperation, need to transfer the knowledge takes the back seat.

   b) **Buyers’ Existing Technology System:** Higher the technological status of the Buyer, higher will be the courage and confidence to seek and retain the knowledge of the system being inducted. The reverse is equally true! If the Seller is exposed to the demonstrated capability of the Buyer, transfer of technology (TOT) will have a vivid shape.

27. There are other factors that too play a role in impeding the TOT. One major concern is that of Govt. policies of the Seller. Several decades ago Pakistan signed and paid for a Nuclear Reprocess Plant with French Government. The plant never saw the days’ light. Subsequent USA pressure made French Government to pull out of the paid deal altogether. So the TOT got killed in the infancy! Another case in point is that of purchase of F-16 from USA. For Geopolitical reasons the contract got mutilated beyond recognition! These are two high-end cases just narrated but, noticing a general slackness in the Buyer team the foreign source will always play on the TOT-tune not audible to the Buyer. Other TOT impairment tactics could be:-

   a) **Superfluous Training:** Ensuring that only that much exposure to the knowledge of the newly acquired system is provided which guarantees future dependency beyond the after-sales needs.

   b) **Inadequate Supplies:** Not the spare parts support but the Equipment sold lacking so that after a certain usage, it becomes obsolete forcing us to repeat-buy

**Transfer of Training (TOTg):**

28. We all, in the decision making hierarchy face the problem of replacing or acquiring a new technological system for our industries. And we get concerned right on the onset, how the technology that we have chosen, will be transferred to the benefit of our production system. This is a perfectly appropriate concern as long as no satisfactory answers are available. Transfer of Technology (TOT) is only one eye of the acquisition system; other eye that we call Transfer of Training (TOTg) has to be kept wide awake if full benefits are derived.

39. In an effort to choose the best technology which speeds the enterprise reach performance excellence, good organization give a lot of importance to the training of its people responsible for the transfer of technology (TOT). However, we seldom recognize that merely insistence on training does not contribute in a significant manner towards the excitement associated with TOT. Only a well-planned TOTg has the potentials of success.

**Characteristics Associated With Transfer:**

30. Trainee characteristics must be considered while choosing the team to augment TOT. These are identified below:-

   a) Ability and Aptitude?
   b) Personality i.e.; having high need for achievement
   c) Motivation: Desire to succeed, high belief in value of training

31. Work environment characteristics also influence TOTg. Some of the pertinent elements are:-

   a) Supportive Organization Climate
   b) Opportunity to Use Knowledge & Skills
   c) Post-training goal setting

32. Barriers to TOTg are identified by researchers Mary L. Broad & John W. Newstrom through a set of characteristic curves.
33. Returning people from training, quickly abandon the learned skills after training due to (a) absence of compatibility of needed skills to absorb high-level knowledge & (b) poor attitude. This is shown by Fig # 5 while Fig # 6 indicates that exponential decay occurred on the learned skills after training due to (a) present work problems (b) diverse cultural attitude & (c) task deficiencies.

34. After return from training the people continue to show high enthusiasm for the TOT for some time, but they suddenly taper off to pre-training level. One of the most commonly quoted cause is an unwarranted pause between the reception of the technology at home and the training received at the suppliers’ premises. The enthusiasm for contribution converts in the frustration. This is shown by Fig # 7. Other reasons for this type of TOTg are:
   a) Unclear course objectives
   b) Poor course contents
   c) Absence of the support system availability
Back home the buyer has not adequately prepared himself and it is not yet ready for the technology to be put to use quickly.
   d) Insufficient opportunity to keep the learned skills.

35. Fig # 8 depicts the quick linear decline to pre-training level. Carelessness in the selection of team for TOTg is cited as the major fault. Other reasons are also identified such as:
   a) Trainees’ fear of failure
   b) Deeply ingrained resistance to any changes
   c) Lack of authority to implement the desired changes.
36. Fig # 9 shows a much more successful outcome. Post training skills levels may be low as shown. But back on the job, over time and with frequent practice and support, the level of performance is maintained and then improves. Only in this behavior curve, can we see TOT & TOTg congruent.

![Behavior Curve](image)

37. Technology transfer experience suggests that organization which involve the people at all levels of hierarchy during the process of negotiations with the suppliers to buy the new technology, succeed in getting the commitment of the people to maximize the advantages. The people become self-supportive as the characteristic curve of at Fig # 9 suggests. But this also means that barriers to transfer are eliminated.

**Barriers to Transfer (TOTg):**

38. A great deal of research in the Transfer of Technology (TOT) and whether it really takes place to the satisfaction of the Buyer, is judged from the good training the Buyers’ team received. Despite the knowledge about several characteristic curves depicting the outcome of the training, it is also prudent on the part of the Buyer to recognize that there exist barriers to transfer (TOTg) also. These are enumerated below:-

- **a)** Lack of reinforcement on the job
- **b)** Interference from immediate work environment
- **c)** Non supportive organization culture
- **d)** Trainees’ perception of impractical training programs
- **e)** Trainees’ discomfort with change
- **f)** Trainees’ view of irrelevant training contents
- **g)** Separation from inspiration of the trainers

**Strategies to improve ToTg:**

39. We as strategists and decision-makers have the responsibility to find out effective ways and means of overcoming the barriers to the transfer. If transfer of technology ToT is to benefit us, we have to evolve or put in place measures to improve ToTg. A few management approaches are given below:-

- **a)** **Build ToTg into Supervisory Performance Standard:** The job performance standards of the supervisors be modified to include the management expectation of full application of learned skills
- **b)** **Review Instructional Content & Material:** Offered by the system supplier in connection with ToTg, the Buyer should actively engage in the review of course content and make it congruent with his culture.
- **c)** **Brief Trainees on the importance of the training:** This is basically a staying-in-touch approach in which we tell the selected trainees about the course objectives & the application on the job.
d) **Provide time to complete pre-course assignments:** This is rarely done in our environment. The selected team of trainees be oriented at home about the syllabus, the readings, the examination procedure; to break the fear of unknown.

e) **Offer Advancement Reference to trainees who demonstrate new behavior:** Before deployment on ToTg the management of the system buyer must spell out to the outgoing trainees offers for possible career advancement. Telling them that new training at supplier premises expects change on the old ways of doing the work. Once accepted, better transfer of newly-acquired skills will take place.

f) **Send co-workers to training together:** Organization should pair the participants in advance of the training to increase the transfer. Single-detailing for large technical system is detrimental to quick transfer.

40. Satisfactory transfer of technology TOT is linked with good planning for entering into agreement with the supplier and supported by a strong transfer of training TOTg

[Diagram showing Transfer of Technology (ToT) and Transfer of Training (ToTg)]

**A Real ToTg May Yet Fall Short Of ToT Expectations:**

41. We observed that major system acquisition programs have their own dynamic; quite a few relevant activities in the transfer process remain dormant until it is too late. You purchased 5-Axis CNC Milling Centre from an Italian Company for the Assembly lines of JF-17 Thunder at PAC Kumara. These very expensive capital assets each costing no less than €3M, will use hundreds of cutters to shape complicated aircraft structure parts. Over time the cutters go blunt and you need to re-sharpen them on a Tool-Grinder. Luckily, you purchased the Tool-Grinder from Switzerland and got the men trained too. Will the re-sharpening occur? The answer is yes. But the cutters can’t be re-used because special coating of Titanium Aluminum Nitride (TIALN) is mandatory on the re-sharpened edge of the cutters!

42. It is not the fault of Italian Firm supplying the Machining Centre to identify the need for a coating plant. His supplied machine is doing the cutting as per drawing; the cutter however will go repeatedly blunt depending upon the frequency of use. You re-sharp them as per the trained method but recoating is a different technological field! If you don’t coat the re-sharpened cutter, it will fail to cut the raw material because the cutting edge is not protected against the dynamic load of the spindle! Hundreds, and may be thousands of cutters engaged in the manufacturing of JF-17 Thunder will queue up for different types of coating. Thus support-system identity and its technology is another area of concern within the ToT context. We got the best ToTg on the mother-system under procurement, we faltered on the Support-System Identity. Therefore, we are not yet fully independent to run the capital equipment acquired!

**Support System Identification (SSI):**

43. The management team engaged in the ToT process should take into consideration the SSI right at the onset of system acquisition program. In the example narrated at Para 42 the need to have coating plant for the
cutters re-sharpening can’t be ignored. Otherwise a prohibitively large inventory of new cutters will be needed to run the manufacturing schedule of JF-17.

44. In this particular case Resource-Pooling strategy with private partners provides the answer. If X number of cutters of type-A go blunt per unit time when the production system is fixed at schedule S, there will be Y number of type-B cutters falling due for re-sharpening in the same period at some other activity of the plant linked to the same schedule S! So, a large mix of cutters though properly re-sharpened, would be queued up for coating! We need to have that coating facility nearby. If we don’t own it because the mix is not large enough to justify acquiring coating plant, we can enter into pooling-arrangement with a private partner.

**TOT & Private Partnership:**

45. One of the major concerns that we can identify and answer appropriately is the need to pool the talents across the country. For quite a long time, we have almost ignored this aspect at Government-level citing “Sensitivity” of the defense project. While we do find a lot of vendors now successfully supporting defense production division in their respective functions, no special attempt is made to acquaint the existing in-country facilities with ToT spirit in mind.

46. Foreign Supplier teams do visit various auxiliary industries to get the confidence for transferring the knowledge. These visits rarely translate in real independence for the Buyer. Referring back to the example of cutters and the coating-requirement; some private enterprise can be entrusted to undertake the coatings task through a policy and entertain all other national needs on coating after re-sharpening.

47. In one of the foreign industrial tours conducted by the author, the international requirement for cutter-coating was pooled at BALZERS Ltd. Switzerland. Almost all the European major metal-cutting industries were regularly dispatching their re-sharpened cutters to M/S Balzers Ltd for varieties of coating depending upon the end-use of the cutters. When we are set for the mega project of manufacturing JF-17 Thunder at PAC Kamra, we will have hundreds of thousands of others falling due for coating. In the absence of a facility like that of Balzers Ltd even a properly transformed technology (of indigenous manufacturing of JF-17), will be of no use.

48. The lesson learnt is that any and all discussions relating to ToT must evaluate the impact of the “ties” associated with the transfer mechanism. The key to a true transferring of knowledge lies with identifying dependencies of life-cycle of the acquired system beyond the core system-knowledge.

**Dependencies:**

49. Even after successful negotiation to acquire the system for the country, we can be dependent on several other factors; both internal and external for the uninterrupted operation of the system across its life-cycle or, the period of ownership. These dependencies are enumerated below:

a) **Internal**: Proximity to the raw material supply is a factor of significant importance. Sugar Mills are located near the farmland cultivating cane. Cement Factories find their installation in gypsum-rich mineral fields. Cotton-seed production attracts Jining Mills. In the context of ToT, our dependence on the source of raw material has to be ensured. Otherwise it can jeopardize the aim of real transfer. You wanted to be the best among Cotton-Seed Suppliers, you are not getting the quality seed and so the acquired technology is never put into use! Another dependency is the trained-labor turn-over. You trained them at a cost, you didn’t provide them the environment to excel. They left you for better place. The transfer never got matured in the first place, forcing us to look elsewhere to sustain the business.

b) **Internal (Corporate Social Responsibility)**: Engro Chemical Pakistan Ltd. acquired a urea plant to augment its annual capacity. While the Transfer of Technology was in progress, Engro realized that its dependence on certain technical specialties is very heavy but the polytechnique institute in the 96KM-belt starting from centre of Sukkur is unable
to make available required technologists to the Engro Plant. Import of trained workers was a big dependence and thus costly to the real aim of transfer. Guided by the CSR thinking, ENGRO & PIDC have recently formed a company called Pakistan Chemical & Energy Sector Skill Development Company (PCESSDC) which will create local talents for industry in the long-run.

c) **External (Raw Material & Specialist Advice)** Despite our best efforts to have Plasma Plant completely transferred to PEC\PIA for independent economic operations of our commercial aviation business venture with GE Aviation USA, we are stuck up with sources of special-powder supply. These raw materials are not produced in Pakistan and are always subject to international pricing index. Cost of acquisition of these metallic powders has a detrimental effect on the sale-price of end-product sold to the Commercial Aviation Industry. The bottom-line is that no matter what technology we acquire life-cycle dependencies must be identified clearly and their impact accurately assessed. Another factor with respect to the TOT of the Plasma Plant for PEC\PIA was periodic calibration to be done by a third party duly approved by the Supplier. Third factor was that End-product user which is GE Aviation USA HAD THE RIGHT TO GET OUR Plasma Plant periodically Re-Certified by independent Technical Auditors. Thus as we progress economically and start acquiring sophisticated plants and machineries, the TOT be negotiated with dependencies-impact (DI) very clearly identified. Not giving due cognizance to this point, can make the core-knowledge transfer issue a bottleneck during the system operating life.

**Some Agreed System Transfer Limits (STL):**

50. Obviously, we can’t have a total cut-off relationship with the Supplier after the system transfer takes place. It is not going to be in the interest of the Buyer to work on total cut-off doctrine. After-sales service, warrantee clauses, specialist advice, Technical Bulletins, Worldwide experience sharing, licensing, regulatory requirements, safety and environment needs and global expending market participation, are the consideration. These shall dictate interactive relationship with OEM through the life cycle of the production system acquired from the OEMs and their partners.

![Fig # 11 (STL)](image-url)
In the Fig # 11 we have shown a few acceptable limits which are called system Transfer Limits (STL) that will continue to be accepted by the Buyer as he enters into the transfer mechanism with the OEM.

**TOT And Value Addition:**

51. All transfer of technology debates hover around perceptions. Buyer thinks and expects that his return on investment should make him more efficient, more agile and eventually less dependent on the supplier in delivering on the objectives across the life cycle of the system.

52. The supplier is also geared and mandated to preserve and protect his market by delivering only the requisite level of knowledge associated with the sale of the system. If at all the OEM delivers what took him decades to successfully design and develop, he will be going against the very business existence of his firm. It is not a car that I buy and drive away! Even in this case, I will be interested to see that authorized garages take care of the car throughout the period of its ownership thus; the garage is a symbol of supplier identity existing way beyond the transfer of the car.

53. In the capital purchase activities, there are no final cut-off dates. To what degree we the Buyers are able to predict cut-off date depends on what value we decided to gain from the system acquisition at the negotiation table!

54. Value is defined as a fair or proper equivalent in money for something sold. If a firms’ product meets a Buyer’s needs and are offered at a price that a buyer considers fair, we can say that business has created value for that buyer.

55. Often mega system acquisitions are perceived unfair & exorbitant for the price paid i.e; with little care given to the value aspect for the buyer. Generally, the value-proposition is judged by three factors.
   a) **Quality:** Let’s call this one the “Q-Factor” by which we mean the tangible, physical aspects of a product, equipment, machine.
   b) **Service:** We will call this one the “S-Factor” by which we will be referring to both the perceived level of customer service (how attentive were those doing the attending?) and the amount of services that were purchased or offered along with the “product”.
   c) **Price:** We will call this one the “P-Factor”. What did you pay for what you got? This is the price!

56. What we are saying when talking about TOT is that we the Buyers must equip ourselves with clear knowledge on value-proposition. We should be very keenly interested in the quality aspect of the Equipment Machines, Plants that we are contracting. Will they operate reliably at different global locations? This question is more relevant to the system acquisition effort which is targeted to become an extension to your already existing technology. Since you have a growth-plan to meet increased demand, the expansion must see that plant being acquired will dove-tail nicely, fulfilling the reliability requirements. Thus, the “Q-Factor” in the value-proposition translates into:-
   a) Matching and balancing with our existing production system.
   b) Is user-friendly yet more efficient.
   c) Causes less maintenance intervals.
   d) Eliminates the need of specialist advice on recurring basis.
   e) Meets increased capacity requirements in the stipulated period of time.

57. The “S-Factor” is also to be considered in the value-chain. “How attentive are those doing the attending?” When you are on the negotiating table nearing the endorsement on the contract for acquiring the Capital Equipment, meet the after-sales people of the system Supplier. Find out how good they are at attending you during the transfer period. Find out the track record of the firm with other customers of the globe. Remember, the more attending a Supplier, the easier the transition.
58. The “P-Factor” tells all! Ask yourself series of questions leading to the satisfactory answer for Return-on-Investment (ROI). If end product produced by you after the system acquisition turn out to be more expensive than the readily available Off-the-shelf, the value is not delivered. Of course, one could argue that system-Supplier has been in the market for a time and the economy of scale has turned it in his favor. If he is supplying cheaper end-product, vis-à-vis you the buyer, he is not that much at fault! Find out from your plan of forecasted sales, the final price-tag acceptable to you in return for a level of independence. Arrive at a perceived “P-Factor” acceptable to you, when the acquired system is well in its successful operation period of time. Try to find out that period as accurately as possible by which you will be independently producing the “Q-Factor” product at a fair price.

59. However, if the system supplier charges so high that RoI goes out of window, you are within your judgment to deny the purchase and re-negotiate, or even choose the other supplier.

60. But do we really engage our-self on value-chain while negotiating a mega contract for the country? A sweeping statement would be No! A couple of decades ago when Mirage Rebind Factory was coming up, the author was undergoing training at the factory premises of SFIM, France. We were being equipped with the knowledge of overhauling Airborne Navigational Components of Mirage aircraft back home. The plant, machinery and the test-sets supplied to Pakistan Air Force by M/S SFIM were deliberately enhanced in numbers so that back home we use them at every stage of overhauling sequence! We identified that we didn’t need those many numbers as were being sold to Pakistan. We were helpless because that was what the contracting Buyer Agency negotiated and signed to purchase! The net cost of sale of the Overhauling Facility became almost exorbitant which obviously had adverse influence on the product we independently produced! It looked obvious that we were better off getting the Airborne Products overhauled in France vis-a-vis at MRF- price wise! Of course the argument by MRF authorities was that Pakistan saved on lead-time not necessarily on the cost!

61. Well in the rapidly changing technology world lead-time, quality, price, responsiveness, innovations have to be given a very thorough analysis before the system acquisition contract is signed. In this value-chain, the transfer of technology attains a new meaning. We in the 3rd World while seeking ToT should be guided that only a win-win approach will keep the ToT spirit alive.

The more of X-area we have in the short-term the better is the environment for true ToT in the long-term.

62. However, the shaded area X, theoretically represents that both Buyer and Supplier are content with the mechanism of ToT jointly put into place. And that the process of transfer was initiated right from the day
parties sat across the negotiating table. It is highly improbable that we never spoke about the value-proposition and yet we attained transfer satisfaction index X in good period of time!

63. Another tool to make sure that Buyer attains a reasonable degree of independence is to let the Buyer have the opportunity to supply end-products from the acquired system, to the Seller. This approach accepts the fact that Seller’s market (national or internal) will accept end-items on a regular basis provided Buyer demonstrates compliance to the international Quality Assurance Standards. This of course, we are referring to as some kind of offset mechanism becoming the part of ToT while signing the Purchase Agreement: Offset is already discussed in earlier paragraphs.

64. Experience of ToT as accumulated by the author suggests that neither Airbus Industries nor Boeing Commercial Airplanes or, GE Aviation USA; felt comfortable to operate the offset honestly or diligently. When PIA purchased 14 Airbus A-310s in 1988 choosing GE Aviation Engine CF6-80C2 powering the airplanes, a total of US$ 32M was the offset that GE Aviation offered. Airbus industries; the airframe manufacturer offered US$ 12 M to PIA as offset. What both these amounts signify that subject to the satisfactory demonstration of the capability prowess by PIA, US$ 32 M+ US$ 12M worth of commercial aviation business, opportunities can be created by these companies for Pakistan and that this offset obligation should be consumed within ten years of the signing of the Airplane Purchase Agreement. Boeing B-777 purchase which took place in Oct 2000, also created an offset of over US$ 100M! What is the ToT status as of now? The answer is provided in the following paragraphs.

65. Today PIA still heavily depends on the spare parts supportability on these Commercial Aviation giants. Precision Engineering Complex (PEC), a department of PIA operates the offsets offered by these companies. Except for the training that a few instructors of PIA Training Centre received at Suppliers’ premises enabling PIA to produce its own Engineering & Maintenance workforce, plus those needed for cabin & cockpits crews, no meaningful transfer of knowledge has taken place! Of course PEC continues to manufacture products for the Assembly Lines of Airbus Industries, GE Aviation & BCA respectively and earns negligible foreign exchange!

66. The offset credit gets depleted at exponential rate each time the specialists from these Firms visit PEC/PIA to do what they call Program Management Review (PMR). For one dollar cash that they spent on their travel, lodging, boarding, they deduct thirteen dollars from the available offset! This is a typical Aviation ToT mechanism that we have described in which our people got the training exposure, our manufacturing capability is harnessed to earn FE, our enterprise i.e.; PEC/PIA got the requisite QA Global Approvals. There is recognition in place that other world aviation companies may get attracted to do the business with PEC/PIA. But beyond these small gains starting 1988 when first mega purchases took place, no major transformation has taken place in the economic independence of the Airline.

67. We now realize that suppliers are far smarter than PIA teams negotiating the purchase deals. There is another truth to our predicament “Pakistan” aviation industry except for PAC Kamra, is in its infancy unprepared to venture on major initiatives. So, PIA can be offered a minuscule piece of ToT in the shape of offset against billions of dollars by system acquisitions! Value-proposition just takes the back seat on the negotiation table!!

68. The message that we must pass on is that we all are responsible for successful ToT-assignments. And that each time there is a major Capital Equipment procurement in the offing, keep the vendor-development status of the country in view.

**Vendor Development System:**

69. Pakistan Automobile Industry is said to be a very mature place for stand-alone indigenization activities. Textile is yet another area Export Promotion Bureau takes provide to repeat. Energy crisis makes us import billions of rupees worth of power-generating equipment. Are we less dependent on the Supplier of System for these three industries? Hardly! Our Deletion-programs are superfluous, to say the least! We continue to have
Suzuki-Altos not Maruti of India! Why because government-private-partnership Level (GPPL) is devoid of true Vendor development spirit. The real transfer of technology (ToT) has not taken place. No attempt has been made to develop the will and infrastructure to transfer the core-knowledge. If we had a sound vendor Development Status, we would be a developed country, not developing one!

70. Transfer of technology is a desire that everyone wishes to fulfill but no one really knows that exact content of ToT which fits into the desire. It has almost infinite aspects representing finite purchases. Only when we learn to identify the limits of the aspects we can then correlate it to ToT & we will be content for the period of ownership. The paper has covered numerous aspects that all future acquisitions must be related to for a win-win relation between Buyer & Supplier as Fig# 13 shows.

71. Always do the things we need to do before we do the things we want to do.

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