Project Success: Integrating Technology Transfer in Major Construction Projects

Bob Hartley, PMP, BH Consulting Limited, Christchurch
Damien Cronin, Phillips Fox Lawyers, Brisbane

1. Introduction

Projects that create new process plants or upgrade an existing facility frequently involve the acquisition and transfer of propriety third party technologies.

The relationship between the technology supplier and technology buyer/project owner is long term. This relationship can commence early in the development phase and frequently extends past the close-out phase in the form of an on-going technical assistance relationship.

Both technology supplier and buyer have a long-term motivation for the successful transfer and application of the technology. The buyer uses the technology to satisfy its own business goals while the technology supplier uses the successful application of the technology to generate future technology sales.

Process technology requires the design, procurement and construction of plant and equipment and the integration of these into an overall project scope. Technology suppliers frequently have limited capability for engineering design, equipment manufacture and construction and therefore rely on third party vendors and contractors to create the physical facilities.

The business entities involved in the delivery phase of such facilities have a shorter-term relationship with the project, which normally ends with the completion of construction and commissioning.

For successful technology transfer, the technology buyer must plan, program and regulate the inputs and behaviours of the contributors to the project over the complete project life cycle and ensure that critical information flows and interactions occur to meet cost, schedule and quality goals.

The Technology Transfer Agreement (TTA) formalises the transfer process and the relationship between the technology supplier and buyer, underpinning a successful technology transfer. There are no standard contract conditions available in Australia and New Zealand for the transfer of technology. Each TTA tends to be a unique document shaped largely by the dynamics of the project it serves and the needs of the parties to the TTA. A number of common themes and issues however, present themselves for consideration.

This paper develops a process model for dealing with technology transfer in the context of the product life cycle and proposes a pro-forma checklist of matters to be dealt with by a TTA suitable for regulating the relationship between the technology buyer, technology supplier and the interfaces to other contributors to a successful transfer of technology.

Part 1

2. Product and Project Life Cycle

Figure 1 shows the typical relationship between the product life cycle and the project life cycle for major construction projects involving third party proprietary technology.

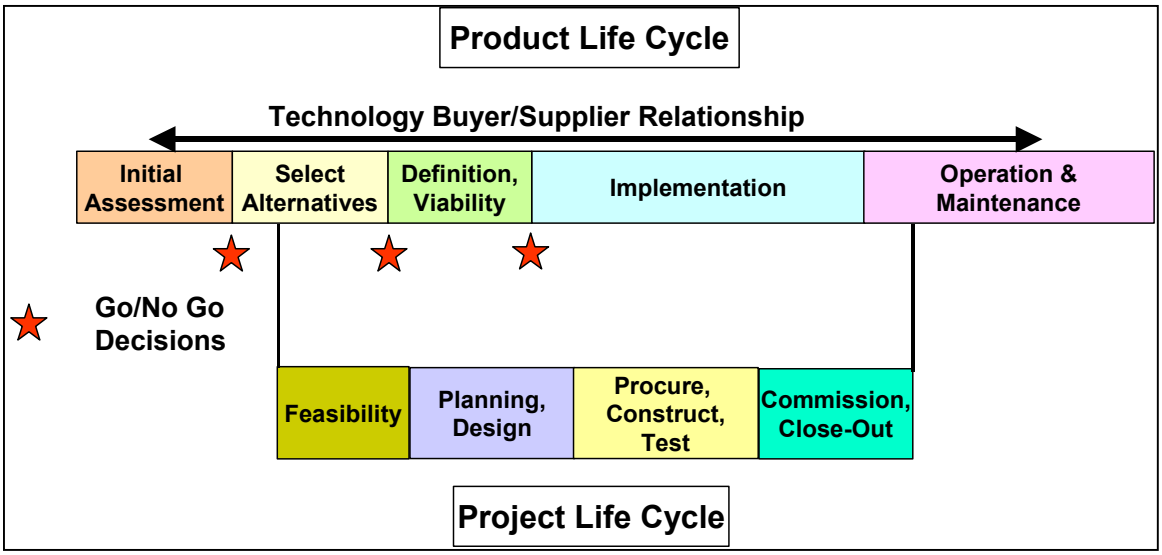


Figure 1. Relationship between Product Cycle and Project Cycle

From the business perspective the project owner's strategic plan identifies opportunities to create stakeholder value through increased volume of existing products or diversification into new product lines. Strategic goals are established and they are achieved by the development and implementation of projects to create new or expanded production capacity. Acquisition and use of third party technology can be an important strategy to maintain competitive advantage and achieve long-term business goals.

From the project perspective the project owner's team has the responsibility of defining and implementing the project. At the completion of the project the project owner's operating team will use the project product to achieve business results.

Technology suppliers become involved in the Assessment phase, (sometimes earlier), and have a continuing involvement through the Definition, Design, Procure & Construct, Commissioning and at least part of the Operations phases. The role and responsibilities of the technology supplier changes through the project life cycle as do the interfaces. Critical information must flow across organisational boundaries and be correctly interpreted by the receiving parties.

Success of the project, from an implementation, operational and business perspective will depend of the quality of the relationship that is developed between the technology supplier, technology buyer/project owner and other project participants. Robust relationships underpin effective communications.

The principal players and activities over the product lifecycle are shown using an "Opportunity Realisation Roadmap"; see Figure 2. The Opportunity Realisation Roadmap is a tool in from Woodside Petroleum's Opportunity Realisation Process (OPREP), which is used by that organisation in project management to show the major activities and decision points across the life cycle of a business opportunity.

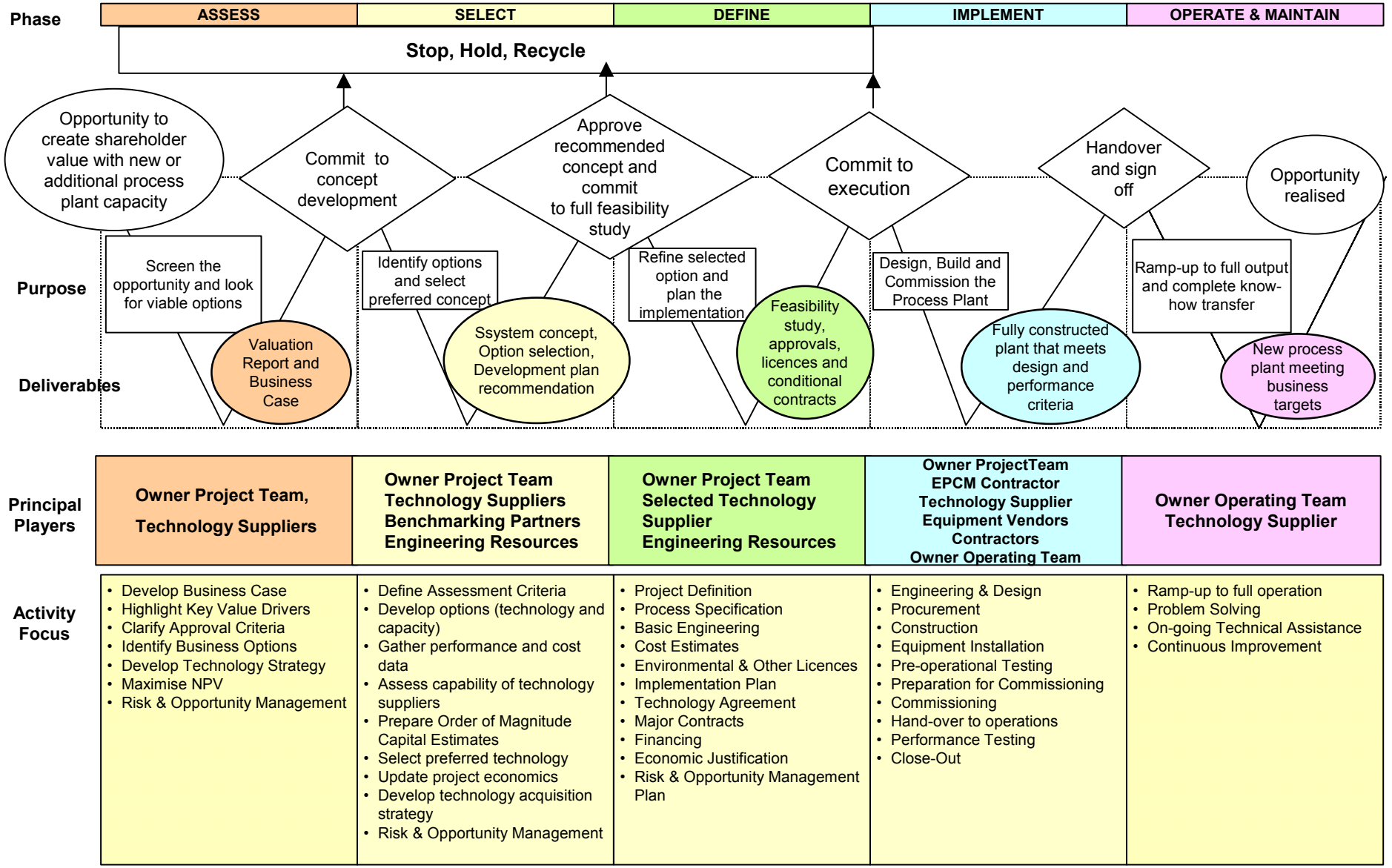


Figure 2 **Opportunity Realisation Roadmap showing the Purpose, Deliverables, Key Decisions, Players and Activity Focus by Phase**

The following are shown for each phase:

- The purpose of the phase
- The deliverables from the phase
- The decision taken at the completion of the phase
- The work focus during the phase
- The major contributors to the work of the phase

2.1. Assessment Phase

During the assessment phase the focus is on establishing a viable business opportunity and providing prima facie evidence to justify the commitment of resources to further project development. High-level information is required from technology suppliers and/or technology users (even where technologies for future possible selection are under development) to generate and analyse business options. In most cases this information flows from market research, competitor analyses and networking contacts by senior executives. Contact with technology suppliers is non-contractual although it is usually subject to confidentiality and non-disclosure agreements.

2.2. Selection

During the selection phase, different technology options are sought and explored. The work is to develop and analyse a small number of options that fit the business objectives. At the end of this phase a technology decision is normally taken and there should be a well-constructed acquisition and transfer plan in place. Technology choice can have a major impact on the financial success of the project. Use of new technology, or proven technology in a new area of application, has a degree of risk that must be managed. The selection process consists of:

- Identifying Process and System requirements
- Establishing Selection Criteria
- Identifying Potential Sources/Suppliers
- Gathering technical performance and cost data
- Assessing the technology transfer competency of potential suppliers
- Analysing the data and making judgements about outcomes and risks
- Selecting the technology option

Contact with technology suppliers is more extensive than in the previous phase. There is a need to understand what exactly would be acquired in some detail but falling short of actual disclosure of the technology. Some technologies are patent or trade mark protected, and if so, public records will go some distance in defining the nature and extent of the technology. Frequently, however, technology consists primarily of proprietary or confidential data, information and know-how. In the context of process plants this is likely to include:

- Raw materials and equipment specifications
- Quality assessment and control methods
- Conceptual design and layout
- Detail design of technology specific equipment
- Equipment supply
- Process flow designs
- Operating and Process control
- Training
- Start up and Commissioning

There is a need to obtain sufficient information from technology suppliers to make informed decisions. It is preferable that this should occur under a formal disclosure process. A technology supplier will generally require the execution of a confidentiality agreement, as they will be divulging information which is competitor sensitive.

In parallel with technical analysis, information is needed about possible commercial arrangements for use of the technology and the method of acquisition and transfer. This specifically addresses the type of licence that will be bought, the deliverables from and support provided by the

technology supplier together with process performance guarantees and the structure of fees and other payments.

2.3. Definition

The deliverable from this phase is a definitive feasibility study (DFS) that leads to a go/no go decision to proceed with implementation of the project. Included in the DFS is a defined scope, cost estimates, economic justification and implementation plan. Generally contractual arrangements (on a conditional basis) will have been put in place with the principal technology supplier/s, equipment providers, and the engineering, procurement and construction management contractor (EPCM) or major contractors.

There will be elaboration of the project requirements, definition of process specifications and basic engineering taking place to develop a work breakdown structure (WBS) for the project. This will lead to cost estimates, schedule development and the project execution plan.

Regarding the technology acquisition, it is at this stage that the details of the technology transfer process are developed, negotiated and finalised which leads to the execution of a TTA.

This process is discussed in detail in Part 2.

2.4. Implementation

The implementation phase is the realisation of the plans and structures set up during the definition phase. Designs and specifications are produced by the technology supplier and acted upon by the EPCM contractor, equipment suppliers (sometimes also the technology supplier) and construction contractors. Technology suppliers provide support personnel to ensure that the designers correctly interpret the information provided by the technology supplier. Similarly the technology provider can assess the technical capability of equipment manufacturers. During construction, technology supplier experts provide quality control support to ensure the facilities are completed to specifications. After construction completion pre-operational testing occurs under the guidance of the technology supplier's representatives.

In parallel with the engineering and construction effort the technology supplier is working with the project owner's operating team to prepare for commissioning. Operating manuals and procedures are written; training of operations and maintenance staff takes place. Practical training may take place in plants already using the technology by agreement with the technology supplier and other organisations.

When the plant is functionally complete it is handed over to the operating teams for commissioning under the technical supervision of the technology supplier. The technology supplier gives on-the-job training and support for efficient transfer of know-how. When the plant has been commissioned performance tests are carried out to confirm that the process guarantees have been met. This usually signals practical completion of the project and close-out occurs.

2.5. Operation

Following practical completion, the operating team ramp-up the facilities to full production and operate to meet business targets. During the operating phase the technology supplier can carry out periodic process audits to assess technology performance against standards to highlight areas where know-how transfer has been insufficient. This will lead to corrective action being taken by the operator or jointly with the technology supplier. The technology supplier is also available provide support to solve technical problems or difficulties that can arise and provide emergency technical assistance if required.

The technology supplier will also make available to the technology buyer improvements to the technology that have been made.

Having provided this background it is now convenient to consider aspects of the actual process of successfully transferring technology.

3. Technology Transfer

3.1. Objectives

The objectives of technology transfer are to replicate the components of a technology in a different organisation and/or location and have the receiving organisation acquire the know-how to consistently achieve the same technical results as the original owner.

3.2. Critical Success Factors for Technology Transfer

The critical success factors for technology transfer are:

- It must work in a consistent and repeatable fashion.
- Delivered facilities must meet safety and operability requirements.
- The technical performance must meet expectations over the total operational life cycle.
- Knowledge and expertise are resident in the receiving organisation to a level than enables them to operate and maintain the process.
- Project cost and schedule objectives are met.
- Contractual obligations have been met.
- Long-term relationships are in place between the technology supplier and buyer.

3.3. Issues to Address

In technology transfer, no one organisation holds all the information. Achievement of purpose requires constructive collaboration and effective teamwork between:

- The technology supplier (who has the process, systems and know-how)
- The technology buyer's operating team (who will use the process, systems and know-how)
- The technology buyer's project team (who will manage the project)
- The contractors (who will engineer and construct the physical facilities)
- The equipment vendors (who will provide equipment systems for the project)

The above parties will have fundamentally different objectives. The technology supplier will want, within the framework of the technology sale, to maintain the confidential and proprietary nature of the technology, the technology buyer will wish to maximise the commercial opportunities from the use of the technology. The contractors and equipment vendors will wish to maximise their profit from their involvement in the project.

In addition, the stakeholder organisations will have their own organisational cultures, and in the global economy there are language and geographical barriers to overcome.

3.4. Technology Transfer Process

Technology transfer can be considered as a series of process steps, each with its inputs and outputs. A typical flow chart is shown in Figure 3.

3.5. Responsibility Charts

The responsibility chart is a useful tool to define the roles and relationships in the technology transfer process. These are best discussed negotiated and agreed in a series of face-to-face meetings involving the contributors.

A typical responsibility chart is shown in Figure 4.

3.6. Team Formation and Leadership

The process flow chart and responsibility chart are useful tools and techniques to assist the technology transfer process, however, as technology transfer is essentially about the flow of information between people, effective team development and team leadership are vital.

The technology supplier's support personnel are a key link to information transfer. An environment must be established where questions regarding design, specifications and procedures are raised immediately when there is doubt or lack of clarity in either the technology supplier's or the

technology buyer's requirements. It is highly unproductive for the receivers of information to make assumptions based on their own previous experience, or to make changes without input and approval from the technology suppliers.

Equally the technology supplier's personnel must be available to answer questions and provide timely responses so that the project work can continue.

Where possible the technology supplier's representatives should be co-located with the project team, and considered full team members. This has major benefits on projects where the technology supplier is located in a different time-zone and/or has a first language that is different to the language of the project.

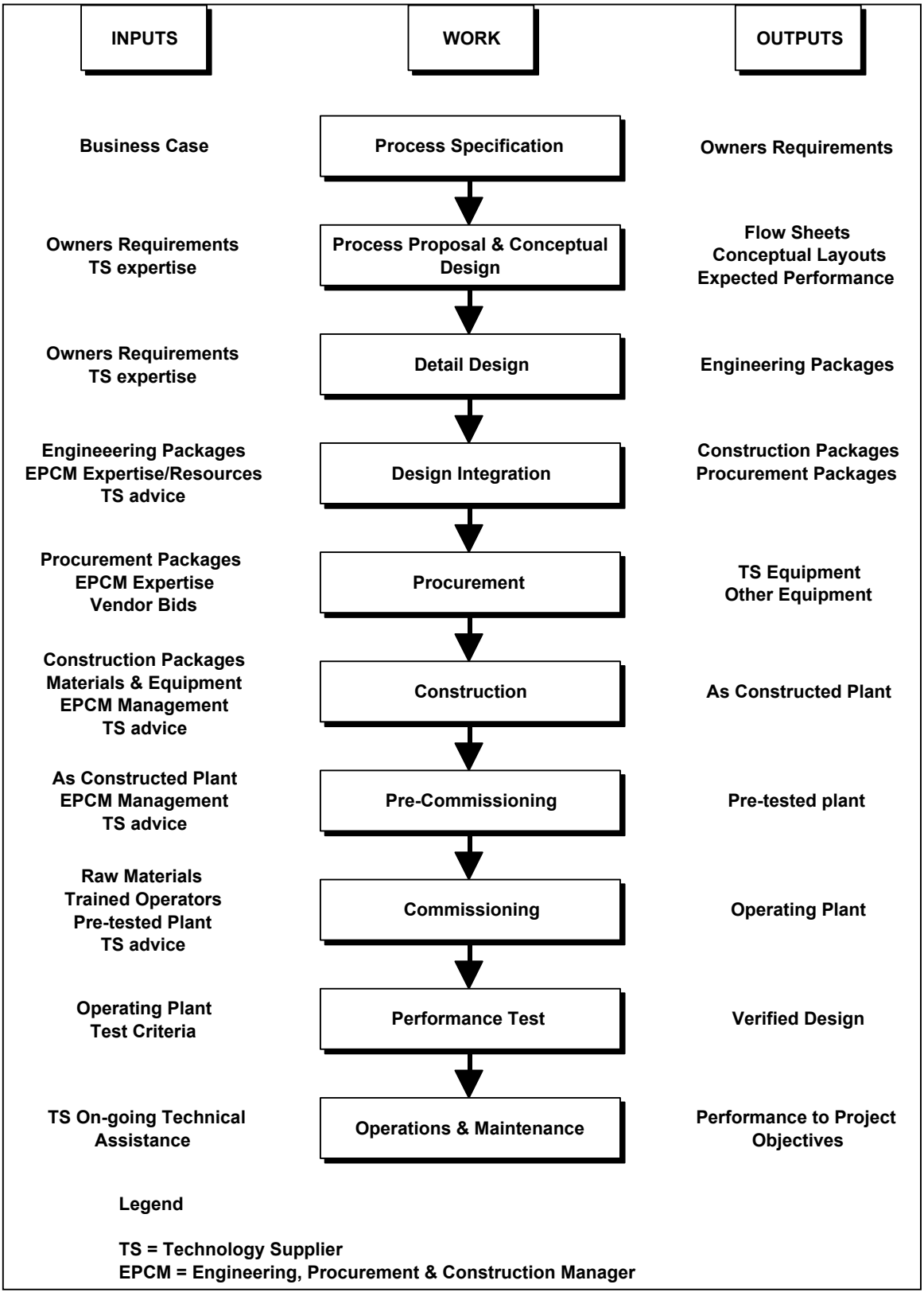


Figure 3. Technology Transfer – Typical Process Steps showing Inputs and Outputs

Work	Deliverable	Project Stakeholder			
		Owner Project Team	Technology Supplier	EPCM	Owner Operations Team
Process Specification	Agreed scope and design criteria	**R**	**S**	**S**	**-**
Process Proposal & Design Concepts	Flowsheets, General Arrangements Process & Instrumentation Drawings	**V**	**R**	**S**	**-**
Detail Design	Engineering Packages	**V**	**R**	**S**	**-**
Design Integration	Approved for construction drawings Approved for procurement specs	**V**	**S**	**R**	**S**
Procurement	Equipment and materials delivered as per specifications	**V**	**S**	**R**	**S**
Construction	Constructed facilities that meet quality specifications	**V**	**S**	**R**	**-**
Pre-Commissioning	Pre-tested Plant	**V**	**S**	**R**	**S**
Commissioning	Plant ready for performance test	**V**	**S**	**S**	**R**
Performance Test	Guaranteed performance level demonstrated	**V**	**R**	**S**	**S**
Operations & Maintenance	Plant operating continuously at required performance level	**-**	**S**	**-**	**R**

Legend

R = Responsibility to carry out the work and make decisions
S = Must support the work
V = Veto authority over decisions taken

Figure 4. Typical Responsibility Chart for a major construction project involving Technology Transfer

Part 2

4. The Technology Transfer Agreement

TTAs regulate the relationship between an owner and supplier of proprietary technology and a technology buyer, as well as the process of ensuring a successful technology transfer. Frequently, as discussed above, parties to TTAs will have fundamentally different objectives. The process of negotiation of the TTA, and the TTA itself, must therefore align those divergent interests and ensure an efficient technical delivery of the technology in the constructed process plant. In doing so, significant rights and obligations will be assumed by both parties.

This part of the paper attempts to identify in checklist form some of the more significant considerations in negotiating and documenting a TTA.

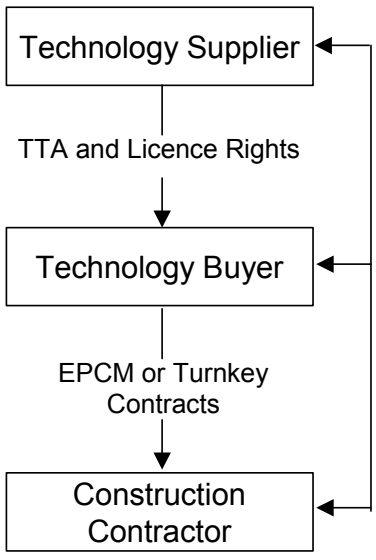
4.1. The Technology

Exactly what is being acquired will require detailed definition, but falling short of actual disclosure of the technology, and this is more fully discussed, in the context of process plants, in section 1.2 of this paper.

However the technology is constituted, it will require detailed definition during the process of technology selection, negotiation and documentation of the TTA. This is so that the technology buyer can clearly understand what it is acquiring, and so that it and its construction contractor, who will provide the detailed plant design, can be confident the technology can be delivered in the as built process plant.

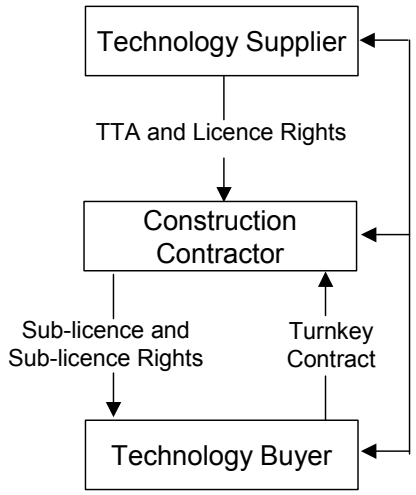
4.2. The Licence

The TTA will grant the buyer a licence to utilise the technology. This may take the form of a direct licence or a sub-licence through the buyer's construction contractor (see the discussion of Models 1, 2 and 3 in Figures 5, 6 and 7).



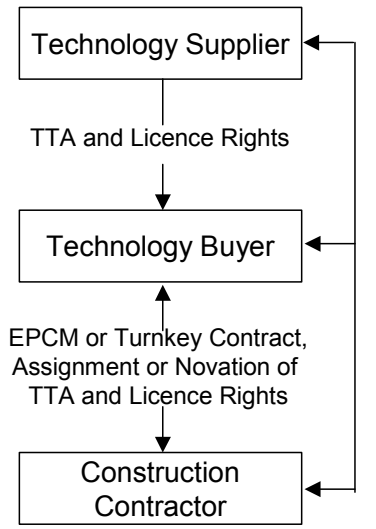
Model 1 sees the rights to the technology passing directly to the technology buyer. The construction contractor does not receive a head licence to the technology or any rights to the technology. Technology is disclosed by the technology supplier to the construction contractor only to the extent necessary to allow the contractor to build a plant. A greater degree of disclosure of the technology to the buyer occurs allowing it to operate the plant and have its personnel trained in the operation of the technology. This contracting model, however, requires substantial intervention by the technology buyer and substantial effort by its technical staff as the necessary link between the technology supplier and the construction contractor. The responsibilities of those parties in all stages of design, construction, start up, performance testing and commissioning requires detailed definition and this definition alone requires substantial effort. This contractual model is suited to either EPCM or turnkey delivery of the process plant.

Figure 5. Technology Licence – Model 1



Model 2 sees the licence rights pass directly to the construction contractor by way of a head licence. Those rights are passed through to the technology buyer by way of a sub-licence. This model requires the least intervention and technical effort by the technology buyer but involves a significant reliance on the construction contractor to effectively and efficiently achieve the necessary technical interfaces between the technology process and the means of delivering that process. This model is best suited to turnkey delivery of the process plant, and to technology suppliers and construction contractors who have a successful track record of earlier collaborative work.

Figure 6. Technology Licence – Model 2



Model 3 is a hybrid between models 1 and 2. This model sees the technology rights passing directly to the technology buyer (and eventually remaining there) but either assigned or novated to the construction contractor for the purposes of receiving and implementing the technology. An advantage is that, because the technology buyer retains a direct relationship with the technology supplier while also having a direct contractual relationship with the contractor, the technology buyer can determine the degree of technical intervention it wishes to undertake. Both the contractor and the technology buyer remain individually and directly responsible to the acquirer for their respective obligations while the overall obligation to achieve a smooth technical interface resides with the contractor. This model is suited to either EPCM or turnkey delivery of the process plant.

Figure 7. Technology Licence – Model 3

The licence rights for the technology buyer's long term use of the technology supplier's intellectual property rights in the technology will require detailed definition. The term of the licence might be perpetual or for a limited term. The licence may be unique and exclusive or non-exclusive. It may give the technology supplier access on certain commercial terms to a share of the product produced utilising the technology or marketing rights to some or all of the production. Often, the technology supplier will require the licence to be site specific whereas the buyer may wish to utilise the technology at more than one process plant.

In the context of process plants, the limit and extent of the licence also requires definition, usually by reference to a stated annual production capacity of the licensed plant. Careful consideration also needs to be given to the transferability of the licence rights to the buyer's related corporations or its co-venturers.

4.3. Technology Fee

Traditionally, technology fees for process plants comprise the following components:

a) A licence fee for the technology rights
b) A fee for training services
c) A daily rate of payment for the technology supplier's technical staff providing technical assistance, design and commissioning services
d) A daily living allowance to the technology supplier's technical staff while providing services outside their country of residence
e) Other items reimbursable at cost (airfares, accommodation, car hire etc).

Most technology transfer arrangements provide for a staged disclosure of the technology by the delivery of engineering packages of increasing design detail at agreed intervals. Payment schedules for the technology fee are commonly linked to the delivery of those packages. However, consideration should also be given to the possibility of the payment of the technology fee taking the form, either in whole or part, of a production royalty. This will have the commercial advantage of removing the technology fee from the capital cost of the plant.

4.4. Taxation

Where the technology supplier is incorporated, or resident in Australia or New Zealand or has a permanent establishment in Australia or New Zealand for taxation purposes, no unusual taxation implications arise. Payment components (a), (b) and (c) above will be subject to Australian GST, if provided in Australia by an Australian resident (or established) technology supplier, or New Zealand GST if provided in New Zealand by a New Zealand resident (or established) technology provider.

Frequently however the technology supplier will be foreign and in that case payment components (a), (b) and (c) will not be subject to a services tax but will be subject to royalty withholding tax generally at the rate of 10%. The technology buyer is obliged to deduct this tax at source and remit it to the relevant tax authority. In these circumstances, technology suppliers frequently require the technology fee to be grossed up by that taxation factor.

Australia's and New Zealand's various double tax treaties with other countries often enable the technology supplier to obtain a credit from the tax authority in its home country for royalty withholding tax and other taxes paid in Australia or New Zealand.

Payment component (d) above will not be subject to any taxation deductions if the aggregate stay of the technical supplier's technical staff away from their country of residence is less than 183 days. Similarly if their stay is less than that period there will be no impact on the technology buyer for other employment related taxes and imposts such as FBT, payroll tax, workers compensation, etc.

Payment component (e) above generally has no taxation consequences, other than the ability to claim on any GST component.

An alternative commercial arrangement to payment components (d) and (e) above could be the payment of a lump sum for technical assistance reimbursables. The administration of these reimbursables is often a significant burden and a lump sum arrangement can act as an incentive to achieve technical performance goals quickly.

Some countries, such as the United States for example, allow a lower rate of taxation on income derived from the commercialisation of intellectual property rights than that on income derived from the provision of technical services. This being so, it is common to split the TTA into two agreements:

- An agreement dealing solely with the technology licence rights
- An agreement dealing solely with the technical services to be provided to facilitate the transfer of the technology

4.5. Technical Assistance

The nature extent and duration and technical assistance to be provided, not only to the technology buyer but also to the EPCM contractor, equipment suppliers and other essential stakeholders, requires detailed definition by the parties particularly in reference to:

- Design and construction period
- Start up and commissioning period
- Operation (for an agreed period)

The following aspects of technical assistance need to be considered. Ideally, the agreed details should be included in a schedule to the TTA.

- The frequency and duration of scheduled technical visits of the technology supplier's technical staff to the design office and the site
- Training requirements
- Details of the technology supplier's technical personnel, their experience and qualifications
- The facilities and allowance to be provided to the technology supplier's technical staff

4.6. Process Guarantee

If a process guarantee is offered by the technology supplier, it will generally be that the completed plant will meet certain agreed performance test criteria. The performance test will generally take place after mechanical completion and commissioning of the process plant. These criteria for a successful test, as well as the protocol for carrying out the performance test, will require definition and agreement, at the time the TTA is entered into.

The detailed obligations and responsibilities of the technology buyer as the commissioning project owner, of the technology supplier and any specialised equipment supplier, and of the construction contractor will require very detailed definition under both the TTA and the construction contract and care is required to ensure that these responsibilities and obligations align appropriately. A number of matters need to be considered.

The respective activities and responsibilities of each party and its personnel require clear definition and agreement. Usually a detailed responsibility chart (discussed earlier in section 3.5) is the most effective means of documenting this:

- Mechanical completion will require definition under the construction contract and will need to be completed prior to commissioning
- Personnel who will undertake commissioning, and their roles and responsibilities, will require definition. Generally, the technology buyer/project owner provides commissioning personnel
- The completion of the commissioning phase will require technical definition as will the point when the plant has achieved a stable operating condition and is generally ready for performance testing
- Consequences of an unsuccessful performance test will need to be considered. These could be:
    - An obligation to re-perform the performance test and, if so, how many times
    - The payment of liquidated damages under the performance guarantee in substitution of a successful performance test
    - An obligation to modify the process technology or the plant itself to achieve the performance guarantee parameters or some acceptable alternative
    - A process requiring a negotiated outcome between the parties leading to acceptance of the plant
    - Resolution by dispute resolution methods

Figure 8, based on a successful project that dealt with these difficult issues, is a graphical representation of a working protocol dealing with these issues.

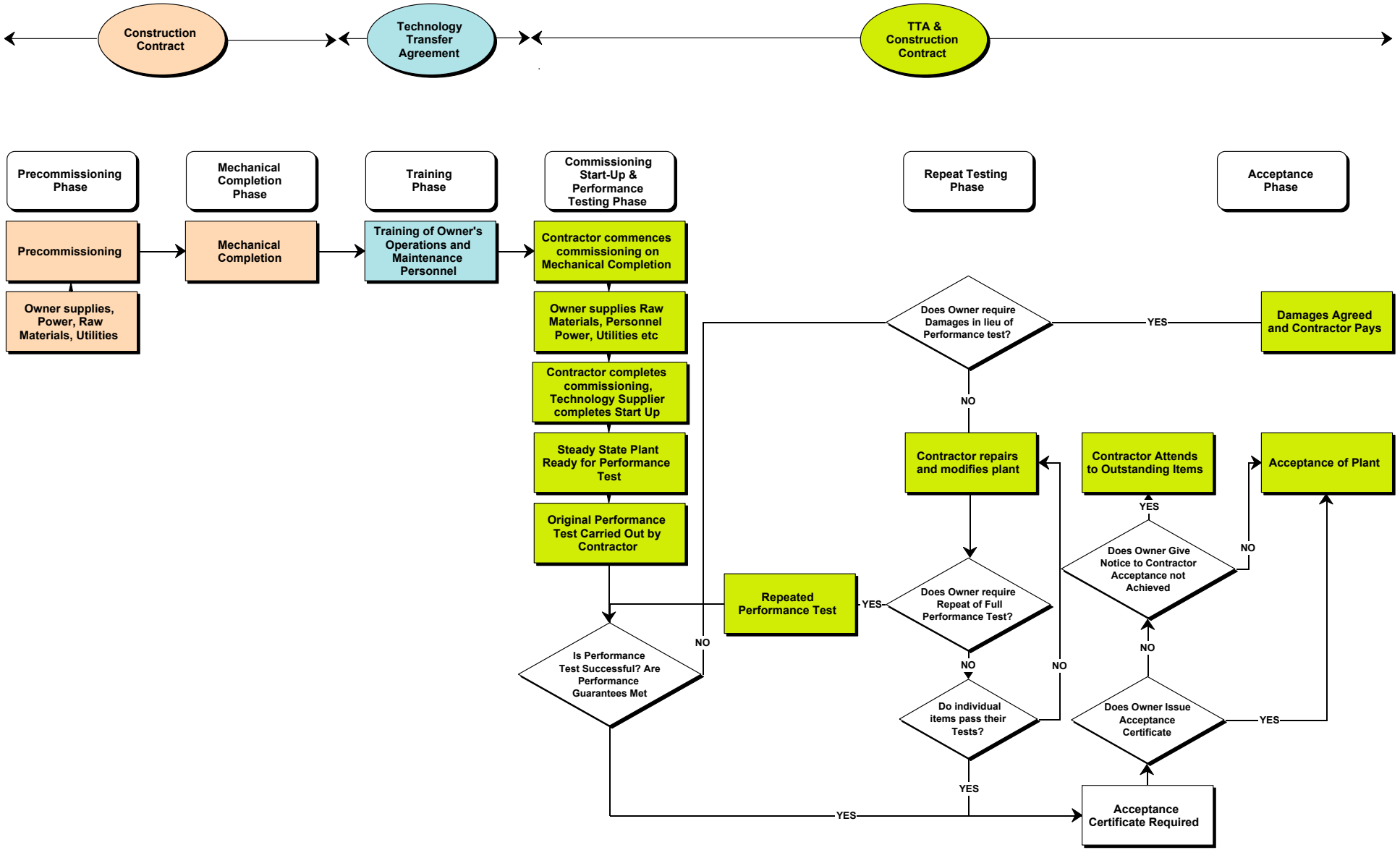


Figure 8 **Process Guarantee and Performance Testing Protocols**

4.7. Infringement

Technology buyers frequently require (and technology suppliers often provide) a warranty that:

- The technology supplier owns the technology and has the right to grant licences of it
- Everything required to be disclosed in order to effectively operate the plant will be disclosed
- The licensed rights do not infringe the rights of any third party

The TTA should deal with two infringement scenarios:

1. Where there is actual, threatened or suspected infringement by a third party of the technology supplier's intellectual property rights
2. Where a claim is made against either the technology supplier or the technology buyer by a third party that the technology supplier's technology infringes that third party's rights

Usually, scenario 1 is dealt with by mutual obligation on each party to inform the other of any actual, threatened or suspected infringement. The technology supplier is generally in the best position to take action itself (and at its cost) against the infringer although the technology buyer may wish to have the right (but not the obligation) to take action against the infringer (usually at the technology supplier's cost).

Scenario 2 infringement is usually dealt with by:

- An obligation on each party to notify each other of any infringement
- An obligation on the technology supplier if required by the technology buyer to defend a claim
- An obligation on the technology supplier not to compromise a claim without the technology buyer's consent
- An obligation on the technology buyer to assist the technology supplier in the defence of the claim subject to an indemnity for the technology buyer's costs of providing that assistance

The additional scenario, where the technology buyer is prevented by a scenario 2 claim from using the licensed technology, is best dealt with by an obligation on the technology supplier to procure from the third party claimant a right for the technology buyer to use the licensed technology. If the technology supplier is unable to obtain that right, the technology buyer should be able to:

- Require the technology supplier to modify its technology and the plant so that it no longer causes an infringement; and/or
- Suspend payment under the TTA if payments are otherwise due at the time infringement occurs; and/or
- Terminate the TTA

4.8. Confidentiality

Understandably considerable attention tends to be focused on the obligation of confidentiality during the negotiation, and the life, of a TTA. The technology supplier will be concerned to protect its technology and to limit its disclosure. The technology buyer will require that degree of disclosure as to ensure a successful technology transfer. Generally, obligations of confidentiality should be mutual and should contain mutual acknowledgment that each party's confidential information is valuable to it and may be used only for the purposes contemplated by the TTA. In addition to a positive obligation not to disclose or permit an unauthorised disclosure, there should be an obligation to ensure that reasonable efforts are taken to protect the confidential information.

Disclosure to each party's advisers, financiers and employees should be permitted, as should any disclosure required by law. In the case of disclosure required by law, each party should be required to disclose to the other any legal requirement to make disclosure, so that the party affected by the disclosure can take any necessary steps to prevent or limit the disclosure, or otherwise protect the confidential information.

A standard form of confidentiality agreement to protect each party's confidential information should be agreed and included in a schedule to the TTA. As a general comment confidentiality agreements for use in major capital projects (of which the licensed plant may only form a part) should be standardised so that

a high degree of commonality and consistency of confidentiality obligations is achieved over the whole project.

Technology suppliers commonly wish to publicise and give examples of their previous technology transfer experience and to have the ability to demonstrate a licensed plant as a working example of a successful technology transfer. Those activities should also be regulated by the confidentiality obligations of the TTA however.

4.9. Limitation of Liability

TTAs frequently provide that the technology supplier's total liability, including consequential losses but not intentional acts of gross negligence, is limited to the cost of rework, or re-performing a service or to an agreed percentage of the technology fee. That percentage is a matter for commercial agreement between the parties. Often the parties agree to undertake mutual obligations to insure their risks and provide mutual indemnities in respect of damaged property, death or personal injury to the extent of any uninsured proportion of a successful claim. Terms of any relevant insurance policy should not permit the insurer to reduce the amount of any insurance indemnity to the parties solely by reason of the existence of such an indemnity.

4.10. Termination

The TTAs termination provisions should deal with the following scenarios:

- A mutual right of termination in the event of substantive breach by either party
- The technology buyer's right to terminate its project and the TTA at its convenience without cause. In this event, the technology buyer will generally be obliged to pay the technology supplier's termination costs. These would be the amount of the technology fee and other amounts payable up to the date of termination and an amount representing reasonable compensation for the technology supplier's forward commitments as at the date of termination
- Termination in the event that, for reasons outside the technology supplier's control (and for reasons other than force majeure events) start up and commissioning of the other plant does not occur. In such cases, the technology supplier will generally be entitled to a lump sum representing its entitlements under the TTA's payment schedule up to the point of the anticipated start up and commissioning date
- Termination in the event any pre-conditions to the TTA are not met
- Termination if an event of force majeure continues for more than an agreed period (say, 6 months)

4.11. Mandatory Equipment

Technology suppliers sometimes mandate the supply of only certain equipment from a specific supplier or suppliers. Generally, if this is necessary in order to ensure the integrity of the technology, trade practices and fair trading legislation will not be contravened. An equipment list showing both mandatory and recommended only items should be included in a schedule to the TTA. There should be, where it can be negotiated, an obligation on the technology supplier to nominate alternative suppliers of mandatory equipment where possible. Where this is not possible and where the technology buyer considers the supply terms unreasonable the technology supplier should be obliged to provide information from the equipment supplier on the commercial conditions that have previously applied for the supply of similar equipment to third parties.

4.12. Improvements

The licensed technology should be in its most up to date form and should include all improvements to the technology achieved up to that point in time when the technology design for the licensed plant is frozen. For those project owners wishing to stay at the cutting edge of the process technology they have acquired, an often difficult issue is the question of how to deal with an improvement to the licensed technology discovered or made by the technology buyer during the term of the TTA. Commonly, this is resolved by both technology supplier and the technology buyer receiving a royalty free licence to use that improvement.

5. Conclusions

Projects involving the acquisition and transfer of proprietary process technologies are complex as they involve several parties whose relationships change over the product and project life cycle.

Project Success occurs when the technology buyer has achieved the technical performance targets within the expected cost and timeframe – and is achieving business purpose.

The likelihood of a successful outcome is higher when

- A process approach is adopted for technology transfer with defined inputs and outputs for each process stage
- Roles and responsibilities of the project stakeholders are negotiated and agreed for each of the project phases
- Decision making authorities are clear
- Technology supplier representatives and support staff are fully integrated into the project team to promote effective relationships and communications
- A well documented TTA is in place

TTAs and construction contracts linked to them are commercially and technically complex documents governing both intricate responsibilities and difficult areas of process/construction interface. This paper can only provide a brief overview of the more significant considerations for both technology suppliers and buyers. Ultimately all outcomes of the negotiation and documentation of a TTA will be judged on the strengths of the relationship between the technology supplier and buyer and the success of the technology transfer.

A well-documented TTA focused on all the areas highlighted in this paper will go some way to facilitating and enhancing both these outcomes.

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