

## ARCHITECTURAL PRACTICE DIALOG - INTRODUCTION TO DESIGN AND BUILD PROJECT DELIVERY

### THE ARCHITECT:-LEADER OF PROJECT TEAM?

You start with a blank sheet of paper, doodling, sketching and picturing the image of the building or a complex of buildings in your mind. Then there are the list of requirements, schedule of functions and accommodations to fit the type of project that you have been requested to design by your client. You are a responsible professional and in tune with the latest trends and technologies. So you want to provide the best professional services and advice for the successful completion of the project at the right cost and time. Yet circumstances may not be within your control. Building delivery is wrought with uncertainties ranging from your clients' indecisions, authorities approvals and most of all the contractors' ability to deliver according to your aspirations. The client's perception of value of your services is a function of his perception of the value he puts on your products. Often it is not in your favour. Client organizations are becoming huge and complex with various levels of managements and personnel. You have to ensure that decisions which are made represent the clients' commitment.

Design is said to be the major criteria for assessment of value. However, not every client is perceptive enough to appreciate designs. More often, the architect has to be a superb salesman to market his design intent and prowess and expect the client to buy it. This sales procedure normally comes in the form of the initial presentation of his sketch designs with three dimensional perspectives to entice the client into understanding and appreciating what he is talking about. Some of us may try to expound design philosophies which are completely alien to the clients' vocabulary. On the other hand, some clients may already have an idea of good designs by virtue of their wide exposure to the finer aspects of life compared to the architects themselves. The demands on the architect's ingenuity and originality in this process are daunting as he can be ridiculed for presenting something which is distasteful to the client.

Design is art. In fine arts, a painting as a piece of artwork stops at the image displayed on the canvas. In a building, design covers complex requirements of functionality and its resultant structure. Cultural linkages that influence designs have been the fodder of inspiration for most architects searching for identity. *Minangkabau roof, tengkolok, kris and pucuk rebong* are some examples of our traditional motifs that have been symbolically transposed onto modern iconic buildings in an attempt to give vernacular meaning to architecture to the masses. "High-tech" became a language in the 80's with steel and glass as the main feature. The flexibility of structural steel gained popularity over concrete having displayed such elegance in Lord Foster's Hong Kong Bank in the late 80's, Petronas Twin Towers in the late 90's to the "birds nest" and the "water cube" of the Beijing Olympics in 2008.

These new structures present new challenges to the designers to come up with more innovative ideas and meaningful structures that represent not only state of the art buildings which are functional but also value and meaning to the clients. Further complexity arises with the advent of IT application in buildings. Building automation and management system require interactive IT softwares and specialist which are not necessarily within the scope of the architectural service. Yet like other engineering consultancy inputs, ICT is becoming one of the major components which the architect has to appraise themselves with. The sketch plans which used to be presented in laboriously drawn plans, elevations, sections and perspectives are being substituted by computer generated drawings and images as well as animated "fly-through" VR.

Technology has changed the way we perceive things and changed the mindset of clients who now expect their consultants to be up-to-date. It is inconceivable that consultants are not wired up or without a website these days. The advancement in ICT has made us more productive and also imposes higher demands on our delivery. Changes and constant updating of the cad softwares are also imposing additional financial burden to our respective organizations. New IT tools are introduced into building designs which require the architects to be aware of their applications.

Mechanical and electrical engineering components are now inundated with new electronic paraphernalia that is not easily understood and sustained. Yet, we need to be aware of them and proficient in their application as part of our professional service. Such is the trend in design today. It is no longer purely art, albeit that is an important element in our service. It is the ability to integrate these complex elements of structures, electronics, functionality and technology into an attractive building that will make architects marketable.

The sustainability agenda has also put architects on alert. The introduction of the Green Building Index (GBI) is designed to make architects proficient in this new discipline to respond to the changing demand of the building industry. PAM's pivotal role in the GBI is applauded. Architectural firms are advised to embark into this important aspect of building and environmental designs in order to remain competitive and relevant. Therefore the number of people and expertise become more daunting and requires a discipline of management to control processes to arrive at a desired outcome.

Traditionally the architect is responsible for the preparation of designs and construction documents that can be easily deciphered by the builder to build the intended structure. The job is manageable when a handful of sub-consultants are involved such as the civil-structural engineers, mechanical/electrical engineers and quantity surveyors. The drawings are prepared under the coordination and supervision of the architect who shall shoulder the full responsibility of ensuring their accuracy and buildability. The task demands maturity, diligence, discipline, creativity and most important of all, leadership. These are the prerequisites to command respect that will ensure prompt delivery. The ability to command respect is predicated by one's ability to optimize the talents and capacities of one's subordinates to achieve results. This is the essence of management. In the complex scenario of diverse personalities and expertise that come together with modern and complicated projects, human resource management is one of the important ingredients for successful delivery.

## **THE MOVING TARGET**

All projects start with contracts between the deliverer and the employer. The deliverer can take various forms, from a straight builder to a turnkey contractor. There are also the specialist sub-contractors, suppliers, consultants and the regulating authorities to complicate matters. The contractors are normally requested to submit their proposed works program for purposes of monitoring progress. The administration of the contract can become contentious when the administrator or superintending officer (SO) attempts to impose adherence to the program upon the contractor. Nevertheless the deployment of scheduling program and critical path analyses does provide excellent monitoring of work progress. The schedule can be the barometer to engage the contractor on a logical sequencing of the various works packages along with the necessary manpower. It can also be the indicator of his diligence on the works which are being supervised by the SO. The SO provides periodic reports to the employer on the performance of the contractor and alerts the employer of deviations to the program and the works.

The complexities of construction supervision and management require constant monitoring and pre-emptive actions to reduce the incidence of mistakes and abortive works. One can expect that targets will be fluid as they are dependent upon the uncertainties of circumstances which are not within one's control. Take manpower as an example. The nature of the works depends on the availability of skilled labour that is in most cases itinerant and inconsistent. If one is unfortunate enough to be landed with a group of unskilled workers then there is a high likelihood of the work being defective and requiring rectification. This will lead to enormous disputes between the SO and the contractor as to the acceptability of the work. The standards and perception of the SO will be the subject of contention between the employer and the contractor. This state of affairs has been ongoing in construction work and has not been satisfactorily overcome. The difficulty that the SO faces is that he has to actually police the work to look out for deviations from the contract documents in order to protect the interests of the employer. In an environment where the level of expertise of contractors is low, the prevention of mishaps and deviations can be onerous. It is unfair to expect the SO whose actual task is to supervise to ensure that the works are in accordance to the specifications, to also direct the method of execution of the work to the workers at the site. Whilst it is a standard procedure for contractors and subcontractors are to submit method statements for each trade, the actual execution is often deviated. It is commonly found that brickworks are devoid of steel mesh reinforcement and starter bars or door lintels that are not properly supported by the brickworks.

Our dependent on foreign labour has not changed for decades. We import unskilled labourers as well as bad work

ethics and workmanship. Recent incident of protest by foreign workers in the media for a prestigious project in the capital clearly illustrated the fragility of the construction industry which depends heavily on foreign labour. This is not within the comprehension and control of the ordinary consultants. Plain contract administration calls for the main contractor to rectify his labour problems immediately in order to adhere to the program. The reality of the foreign labour supply is that it is a controlled commodity. Hence, it has evolved into a sophisticated industry that is privy to a handful of suppliers or agents. The quality and integrity of these workers are not fully regulated which gives rise to the bad work ethics and workmanship. He faces the dilemma of engaging the illegal workers and risks the inability to deliver the project. The shortage of workers in the construction sector has been a national concern in view of the increasing number of projects that the government is embarking on for the 10th Malaysia Plan and the New Economic Model. They are necessary for our economy while also being a threat to national security. Alternative construction methods to lessen the dependence on labour are long overdue. Buildings should also be designed to adopt new methods of construction such as prefabrication and industrialised systems.

There is a need for competent and experienced construction managers and supervisors from the contractor's side to ensure that their workers fully understand the best building practices, translation of the drawings and specifications into proper method of erection and installation. Any deviations will result in abortive and delays in the delivery of the works. In a complex program or schedule involving multitudes of trades and specialist inputs delays or defects in any of the components will have a knock-on effect to the total program which will call for reviews. Sophisticated construction management programs are available in the market that develop critical paths for project implementation. They are useful tools to guide the construction managers to anticipate activities and provide early warning alarms for breaches in the schedule and for events which are beyond the contractor's control. However, there are no excuses for deviations for incompetence in the execution of the works. Invariably the SO has to review the targets in order to make good the delay in the hope that there is enough float time for the works to catch up. If the knock-on effect is so severe, a bottleneck may occur at the later part of the construction period which will be a definite recipe for delivery failure.

The fluidity of design and functional requirements in large and complex projects are the main contributors to divergence in project schedule. In a turnkey project not all requirements of the end users can be determined in detail at the project's inception. The client's agent cannot specifically develop the brief of requirements without consultation with the relevant end users. These end users would also need to apprise themselves with the base plans to spell out their needs. For example in the case of an airport, the end users consist of the police, airline operators, security organization and systems, concession tenants, customs, immigration departments, maintenance organization and most important of all the airport operator. In the case of a hospital, the end users are the specialists, doctors who have diverse needs and perceptions of the hospital and the operator. In all hospital projects in this country, interaction meetings to determine the detailed briefs and needs of the end users proceeded well into the construction stage. Thus the construction drawings have to be amended and updated accordingly. This poses a severe strain on the project schedule which has to be adjusted likewise. Hence the targets which had been established at the outset were constantly changed to accommodate the decisions or lack thereof.

The construction manager is responsible for proper coordination of works on site. He needs to plan the works taking into account the various components of works, procurement, logistic, labour, manufacturers, specialist products, safety and security, etc. Perhaps the most important element in the building process is the drawing production. In conventional contracts of Design-Bid-Build, the drawings which form part of the contract document are completed before construction begins. Of course, it calls for high quality and accurate drawings. The recurring problems in this method of delivery are principally due to the lack of details in the drawings as well as the frequent unexpected technical problems that surface during construction. The high incidence of constructional problems is also due to the lack of details and coordinated drawings offered by the consultant architects and engineers. The contractors are usually left to resort to their own devices and ingenuity to resolve the problems in order to maintain their budget as well as time of delivery. Sometimes their solution works, but most of the time the results are compromised.

It is a general practice where the contractors, sub-contractors and suppliers provide shop drawings for construction and installation which are then sanctioned by the SO or consultants before execution of the works. Therefore the consultants are not able to determine the extent of the details that are required for the installation. Invariably these details and technical requirements have direct impact on the progress of other related works. For example the differing types of air-conditioning systems require openings and chases that are peculiar to each type. The construction manager must be determined enough to commit to a type in advance of the works to allow for the shop drawings to

be timely prepared for the coordination with the other civil and structural works. Alternatively the M&E consultants need to design a flexible system which can be installed without severe impact on the C&S works or. The introduction of the Building Information Modeling (BIM) appears to necessary to overcome the current weakness in design documentation and coordination.

The overlapping of M&E, architectural, specialist, and C&S works is the challenge for construction management. For each of these items of works there is a multitude of factors that govern their delivery. The most important of all is the delivery of DRAWINGS. Sufficiency of drawings is the common topic of discussions in all project implementation meetings. The associated subjects for discussions are;

- *technical accuracy and competency,*
- *well coordinated,*
- *timely delivery and*
- *updated changes.*

**Technical accuracy and competency** demand proficient and perceptive consultants and draftsmen. Errors in dimensions can be disastrous and costly. At the outset of project documentation the base plans for all relevant consultants shall be an accurate survey plan of the lot. This plot plan must be derived from the document of title which is confirmed by the physical survey of the land by a licensed surveyor. The working drawings which are built upon it shall finally consolidate into comprehensive construction drawings. For easy reference, the plans are coordinated on an X-Y axis with control grid lines properly dimensioned. Similar control lines are provided for the vertical dimension, usually depicted by the floor, ceiling lines and window lines.

The amount of information and specifications that can be incorporated in the drawings is limited by the space available on the drawing sheet. It is normal practice to codify or schedule the description of materials and structures to avoid cluttering and for easy reading. Thorough checking is required to avoid errors. An oversight in the interpretation of column schedules will affect the positioning of walls, ducts and even sizes of rooms. Similarly the setting out and dimensioning of floor outlets, services penetrations, wall sockets, etc. can result in costly but ineffective rectifications. Simplistic assumption of the vertical dimensions of ceiling spaces can be erroneous if the depth of lateral beams is not checked as to whether they will be in the way of services pipes, cable trays and air-conditioning ducts. It is good practice to segregate the electrical/telecommunication services lines/trays away from the water reticulation and sanitary pipes. Cleaning eyes should be accessible easily and not blocked by other pipes. Openings in floor slabs such as floor traps or toilet discharge outlets must be scribed on floors after taking into account the final finished dimensions of walls and floor in relation to the fittings. The use of couplings to connect wc pipes to floor openings should be avoided. The SO must ensure that these elements in the drawings are checked before the relevant drawings are transmitted to the contractors at the site.

The coordination of various drawings prepared by the architects, engineers and other specialists is not only a tedious task but also requires highly experienced personnel to execute. This is normally undertaken by the project director's office which should be sufficiently manned by the appropriate and experienced professionals and technicians. One has to know exactly how each package of work fits together that eventually makes up the entire building. For each room one has to know the final finish of the product ranging from the various finishes to all exposed surfaces to the fixtures and loose furniture. Room data sheets and drawings are useful for this purpose. Accordingly, one has to see the builders, mechanical and electrical services works that are hidden behind the surfaces of floors, walls and ceilings for each room and together to the overall network or services of the building in its entirety.

The above moots the notion of **well coordinated** drawings and documentation. In the traditional building delivery process the architect assumes the role of principal coordinator of all other consultants' services for the project. These shall also include the works of specialist who may be engaged according to the complexity of the project. At the least he is to ensure that the works of the C&S as well as the M&E engineers are coordinated with the architectural and builders works. The gaps which appear when the M&E services are executed during construction are mainly due to the absence of properly prepared coordinated drawings and shop drawings. It is common practice, in this country, for shop drawings to be prepared by the contractors who accordingly engage various relevant specialist subcontractors, who prepare their own shop drawings which are juxtaposed on the relevant sections of the build-

ing. Several layers of shop drawings are then developed for the consultants who are normally tasked with the checking whether the system is acceptable in accordance to the performance specifications. Drawing coordination breaks down will result in numerous abortive works and in some instances design failure. Remedial actions will have to be carried out which result in delays and escalation in costs.

Most M&E engineers are reluctant to prepare shop drawings or coordinated drawings with the misconception that the M&E system to be adopted cannot be determined unless the specialist subcontractors have been appointed. This state of affairs has caused endless anxiety among clients who have to bear with the uncertainty of the final product. The architect, on the other hand, maintains that this is also not his responsibility as it also not within his scope of expertise to do so. Since it is not a common practice for consultants to prepare these drawings, there is also a dearth of talent in the consultants firms who are capable of executing these works. This situation has not improved till today. Building Information Modelling (BIM) is designed to overcome these weaknesses. However the migration of the popular cad system to BIM is alarmingly slow. It requires a total change and review of the building industry.

In the case of Design and Build, coordinated and shop drawings are mandatory requirements for the execution of the construction works. The consultants who are engaged by the turnkey contractor are required to expend their respective expertise to include the preparation of these drawings. It, therefore, demands innovative, diligent and proactive effort as well as a change in the mindset to accommodate a new working environment. In a complex building project the extent of M&E services requires the consultants to be able to anticipate technical problems in coordination of the works. It is therefore necessary to translate all schematic and line drawings that are traditionally practiced into detailed working drawings and shop drawings that can be used for construction. These drawings must also be comprehensive to enable the quantity surveyors to take off accurately the quantities and prices. The traditional method of approximate taking off by the M&E engineers based on schematic drawings and anticipated loading for air conditioning is NOT acceptable due to inaccuracies. Besides, the very act of developing and documenting the shop drawings will reveal numerous technical issues which can be resolved very early rather than having to resolve them during the construction and installation or leaving them solely to the various specialist subcontractors to invent their own solutions.

Decision making is a crucial element in ensuring the smooth flow of construction activities. Sound decisions can only be made with accurate information, which is derived from *timely delivery* of accurate coordinated drawings. While one may resort to the provisions of the contract for default by the contractors or subcontractors for delays or defects, the fact is that the project delivery has suffered. A day's delay due to indecision can result in a month's delay in construction.

The drawing and design office or department of a construction firm is analogous to the production line of a product manufacturing factory. The organisation of the drawing office has to take into account the hierarchy of personnel who are in charge of the various aspects of the project and types of drawings to be produced. In most building projects the originator of the drawings is usually the architect. They can be the working drawings showing the plans, elevations and sections which are then translated by the C&S engineers into structural GA drawings for setting out the foundation, piles, and structural framework. The engineers are expected to understand the architect's design intent in order to develop the structural design including philosophy and interpretation of the various codes and regulations. The interaction between the architect and engineers in the department is intense for arriving at viable engineering solutions that have been put through the test of value engineering. Subsequently the resolved technical issues have to be documented in the relevant drawings for transmittal to the working contractors.

The design development process can be protracted due to circumstances which are beyond the control of the architect or the engineers. These may arise from requirements of the client, approving authorities or site conditions. It can involve numerous changes to the drawings and sometimes the sequence of work on site. *Updated changes* to the drawings have to be made known to the relevant departments in the organization and individuals related to the project. For the purpose of construction, the sub contractors and supervisors must be equipped with the *latest* drawings for reference. Mistakes in construction are commonly caused by the use of outdated drawings that somehow got into the hands of the foreman on the project site. A system has to be developed to ensure that everyone is referring to the latest updated drawings. A Document Control system must be installed to track and administer the transmittal and movement of documents and drawings pertaining to the project. In cases where the SO issues instructions to the contractor including sketches to elaborate the works, the Document Controller should be notified enabling him to trace the movement of these instructions. Properly documented movement of drawings and correspon-

dences are important in settling disputes that may arise later.

In the course of construction the qualified SO and Clerk of Works play important roles in identifying problems that may arise. Their technical competence in understanding the design intent as shown in the drawings and in relation to what are being constructed is pivotal to a successful and optimal construction. The principal architect or engineer will not be at the site full-time and depend on the integrity of the SO and CoW to notify them of the progress and issues related to the construction. If the shop drawings and detailed construction drawings are prepared before construction starts, these problems can be minimised. Otherwise, the SO and CoW's are expected to alert the architect or engineers immediately of the problems so that they can be resolved accordingly and promptly.

## **MANAGEMENT ORGANISATION**

The success of any venture or project depends on the effectiveness of the organisation that is entrusted to execute the project. There are numerous theories that deal with management including specific graduate and post-graduate courses on the subject. However, at the end of the day it is the successful delivery of the task that measures the credibility of the management. So it is crucial for the management system to be established at the outset. In a conventional Design-Bid-Build process, the contractor enters into a building contract with the owner where the consultants act as supervisors and administer the contract. The management of the contract is led by the consultant, who is usually the architect. He may be indifferent toward the manner in which the building is constructed or the construction management itself. This is in view of not wanting to be liable for interfering with the contractors' obligations. Accordingly, the architect may not be sensitive to the plights of the contractors such as inability of procuring suitable manpower, materials and good workmanship. This is a frustrating chain of events that has led to many breakdowns in building contracts and even abandonment of works. The architect may be called upon to resolve these problems which may be beyond his expertise or call of duty.

I wish to suggest that the architect and other consultants take a bold step forward to step into the shoes of the contractor and understand the complexities of building a project. Only then can they administer a contract fairly and with full understanding of the processes that go into building construction. This opportunity can prevail in the Design-Build method of delivery, but demands changes in the method and mindset of the consultants.

The management structure is dependent on the manner in which the construction company executes the works. In this country most construction works are carried out on the basis of subcontracting packages in one form or another. It is uncommon to find a single contracting company that has either the capacity or the expertise to undertake every single works packages wholly on their own. Separate works packages are carried out by different subcontractors and/or specialist suppliers. Some of these works packages can be as listed below;

## **EXTERNAL WORKS**

- Earthworks
- Roads and drains
- Water reticulation and reservoir
- Electrical reticulation and substations
- External telecommunication trunking
- Sewerage reticulation and treatment plant
- External lighting
- External signage
- Landscaping

## **BUILDING WORKS**

Civil and Structural

- Piling and foundation
- RC and structural framework

- Prefabricated Columns and Beams

Builder's works which can be further broken down to;

- Brickwork
- Prefabricated wall systems
- Ceiling
- Doors
- Windows
- Curtain walling
- Wall and floor finishes
- Plastering
- Painting
- Sanitary fittings
- Built-in furniture and signage
- Roof frame and roof covering
- Rainwater plumbing

Mechanical Services

- Air conditioning and mechanical ventilation
- Cold and hot water plumbing
- Sewerage piping
- Lifts and escalators
- Fire protection
- LPG system
- Rubbish disposal

Electrical Services

- High voltage electricity supply
- Low voltage electricity
- Telecommunication
- Generator set
- Security, CCTV, alarm and access
- Lightning protection
- ICT and building management and maintenance system

Each of the above works packages requires a dedicated team of workers and installers who must be coordinated to combine as a united team with the singular aim of delivering the building with the least hindrance and mistakes. Therefore the principal contractor should provide all facilities that are needed to expedite the building process. These amenities and facilities are normally accounted for in the preliminaries. They include the following;

- Site maintenance
- Health and environment
- Site access
- Insurance
- Site vehicles
- Safety and security
- Staging and scaffolding
- Temporary power and lighting
- Temporary water supply
- Site offices
- Labour quarters

- Canteens
- Mobile toilets
- Tower cranes
- Storage spaces
- Hoarding

## PROJECT DIRECTOR DOWNWARDS

The management organisation may reflect the functions and discharge of each of the above works. At the outset the contractor may nominate an overall Project Director who will oversee the coordination of all works packages. He shall be supported by other package managers, site supervisors, schedulers, quality controllers, etc. The task is to ensure that the coordination of the construction works is effective in terms of quality, cost and time. He has to implement all policies, activities, procedures and instructions as applicable and required by the *Project quality system*. The quality assurance and control system for the project should be established very early in the contract. It provides the bases for orderly execution of the works together with the records of every activity, which will be useful to arbitrate disputes and tracking assets relating to the project. The QA/QC system also defines the detailed job description of each of the personnel in the construction organisation as well as the procedures and methods of execution of the works. It should be a department which is directly connected to the Project Director so as to ensure consistent permeation of the Quality culture throughout the whole organization. Intensive training and orientation are needed to develop the understanding and application of the system at every stage and aspects of the project. This also requires the full commitment of the consultants to exercise the application with the support of the supervisors and CoW's. The ISO certification has now got to be upgraded to include the Intergrated QESH management system to ensure good practices on environmental, safety and health management in the execution of the works.

The works packages can be grouped together and be charged by an assistant construction manager (ACM) for each. The Construction Manager who is assisting the Project Director can call upon each of the ACM's to report on a daily basis for the purpose of coordinating the various works. Information flow to other relevant departments such as procurement, contract and finance is important to ensure that technical issues and discrepancies can be rationalised and resolved effectively as they will impact on the project cash-flow and budget. This can be achieved by holding regular meetings of the ACM's at least weekly. In some cases a daily meeting at the end of each working day is advisable to review the day's work and related issues as well as prepare for the following day's work, particularly at the initial stages of the work. These daily meetings are called *tool box meetings*. They are also useful for ensuring the technical competencies of the various ACM's and their respective understanding of the drawings and their technical implications on construction methods and results.

The management organization requires a **Planner** who is in charge of the project construction programming and scheduling. At the above meetings the Planner shall advise the ACM's on the conformance of the works to the programs and advises on deviations. The meeting should resolve the necessary actions to address the deviations and transmit the instructions accordingly to the relevant personnel who are the cause of the delays. The importance of program and scheduling must never be underestimated. It has a tremendous impact on the cash flow and the procurement of the various works packages as well as materials that are to be installed. The timing for choosing materials and procuring their approvals from the owner is an important item in the project schedule.

At various stages of work there will be items that require inspections, such as underground services, formwork for concreting, wall and floor chasing for conduits and sample finishes. For large projects, a full size mock-up of special design feature should be erected. The inspection process requires adoption of procedures and records. A *Request for Inspection* (RFI) forms are normally needed which can be inspected and cleared by the resident engineer or architect and accordingly recorded by the Document Controller. This in addition to the statutory inspections as required under the UBBL and the CCC procedures. Ideally at each stage of the CCC stage the relevant works should have been discharged satisfactorily before signing off. In reality these stages of work overlap and frequently the NCR's have not been closed yet.

The RFI's are necessary to ensure absolute adherence to best building practice. The monitoring of the works is based on the agreed *method statements* which are submitted by the respective works package contractors. Each of

the ACM's and COW's must be familiar with the *method statements* so as not to be misled by the works contractors into accepting alternatives. This is where the tool box meeting becomes relevant to coordinate the mutual understanding among the CM, ACM's, resident architects, engineers and COW's.

## DESIGN AND TECHNICAL CONFORMITY

The contractor's obligation is to deliver the project in accordance to the contract documents, which include drawings and specifications. In a fast track turnkey contract which is normally applied in Design and build contract, the detailed drawings are not fully developed at the point of award. Usually there is a provision for design intent and performance specification which the contractor has to follow. This can be contentious if the document is not watertight. Preliminary designs and performance specifications which are used for the calling of tender should also call for contractors' design and technical proposals to conform to the design intent of the project at the outset. The quality of drawings and intent as produced by the consultant architect and engineers will be subject to scrutiny and debate. This can occur in the question of functionality or fit for purpose. A lesser provision for these aspects can result in changes in design or construction process which is also the cause of the moving target. There are cases where the works packages are extricated from the main contract and dealt with separately. This gave rise to complications where the main contractor and even the consultants lose control of the supervision and management.

The interactions between the contractor and the consultants are further recorded in the regular *technical coordination* meetings. **Technical information enquiries** (TIE) are also recorded using a proper format which has to be responded by the consultants promptly. The quality system will stipulate the requisite *turn around time* for the TIE which is programmed in the work schedule. The TIE's are tracked and monitored at the weekly meetings. The volume of TIE's is dependent on the completeness of the drawings. They are requests for clarifications by the contractor on technical details, drawing details, conformance to prevailing building by-laws and regulations, etc. The consultants can be trapped in a dilemma if he is not astute enough to handle enquiries which can be used as excuses for claims. Arguments between the consultants and contractors are common in these cases particularly when the contractors are manned by qualified consultants who are more experienced in the construction field than the consultants for the building. In the current shortage of experienced professionals, the consultancy firms are very hard pressed to provide satisfactory level of services that commensurate with the fees that they earn. Mistakes that are made by consultants are generally borne by the client as local clients are generally not litigious toward consultants due to their lack of financial strength. It will be futile for the building owner to resort to punitive damages from the consultants. However the situation is changing rapidly with clients insisting on consultants taking up professional liability insurance.

The current practice of engaging the consultants as an independent consultant to oversee the works of the Design-build contractor has some weaknesses which are attributed to the differences in interpretation of design particularly in structural engineering matters. The true design and build approach is adulterated by the need for assurance by the client from independent consultants. There is still a lot of scepticism on the contractor's design which tend to hinder the smooth execution of the construction. This scepticism has resulted in an approach by JKR to have direct contractual linkage with the consultants, thereby limiting the control of the contractor over their conduct and performance. This includes the process of checking, detailed design clarifications and development. Mistakes and delays by the consultants are burdened by the contractor who may not have any recourse against them as the contractor is contractually bound to deliver a functional and fit for purpose building timely.

It is also argued that the contractor's design may not be up to the mark by the independent consultants, therefore justifying the need for an independent consultant. This argument is defective which is based on the assumption that the contractors are incompetent designers and engineers which defeats the purpose of awarding the works to the design-build contractor in the first instance. On the contrary, there are already a growing number of contractors which are highly capable of designing works and are even more pragmatic due to their experience in ensuring that the designs can be built.

The current contractual provisions normally require the contractor to guarantee the performance of the building up a certain number of years. JKR requires the contractor in a design and build contract to provide maintenance for up to two(2) years and five(5) years design and performance guarantee. These provisions are not tenable for consultants who are not as financially strong as the contractor. The contractors are usually the ones who are bearing the risks for design failures. It will be foolhardy for the contractor to take unnecessary financial risks by compromising

on the performance of the design. Where subcontract packages are concerned, the supervision of such works package becomes the main contractor's nightmare. This is where compromises may happen and calls for closer scrutiny. The subcontractors may not be fully exposed to the principal liabilities and responsibilities as that faced by the main contractor. A proper system for procurement, contract drafting and supervision where quality and financial standing of the subcontractor must be the main criteria for selection.

It has frequently been reported in the local media about the rampant bad workmanship in construction. While this may be true in some instances, there are also good quality works which are not reported. The role of the SO and CoW's is the determinant of quality. In a conventional design-bid-construct contract, the Resident architect and engineer have a principal role to ensure that the contractor carries out the work in a good workmanlike manner. The incidences where bad workmanship in public projects stem from poor selection of contractors as well as supervision of building works. The CoW's have to be vigilant and on the lookout for deviations. QESH management can facilitate good workmanship. A CoW who does not carry a tape measure and measuring gauge for reinforcement bars should not be on site. Insufficient lighting and safety measures such as barriers and scaffoldings will lead to bad work.

## DESIGNS AND IDIOSYNCRACIES

A Design and build organization is like a manufacturing outfit comprising of a team of designers, quality controllers, research and development personnel, procurers and managers who will deliver the product that was promised in a contract. The design at the outset is the selling point for the organization. In this case it is the architectural design prepared by the architect. A comprehensive D&B outfit may contain a full multi-disciplinary team of professionals in the building sector. It can and will provide a comprehensive service from design to construction. However, what is commonly practised is the grouping of independent consultants, architect, engineers and other relevant consultants for the particular project. One can expect teething problems initially with respect to the integration of individuals who may be set in their minds on some aspects of design and drawing delivery. This problem, if not arrested early can jeopardise the progress of construction. Everyone must act as a team with a singular mission to deliver the project on time, with quality and within budget.

In order to overcome barriers and peculiarities among personnel, the teams should be given the opportunity to assimilate with each other. This can be done by conducting courses in motivation, team building and personal development which aims at achieving unity among team members. I would say that a successful project team is not unlike a champion soccer team. Each member should be able to anticipate and respond positively to one another's movement and thoughts in order to score the goal. So, excellent *communication* among members is paramount. This can be further enhanced by having everyone involved in the project stationed under one roof, preferably at the construction site. Quite often the consultant's team prefers to work in their respective offices and communicate directly with the supervisors, CoW's and resident architects or engineers. This is not good enough for one to appreciate the magnitude of constructional problems that arise during construction. The consultants must come to realise that conventional working approach and methods do not apply. It is disastrous for consultants to carry the attitude of demarcation, i.e. to be indifferent toward other tasks which may not be within his purview. In a Design/build case the line of responsibility is rather fine to be pedantic about what is ones role and what is not. Taking to the extreme, the checking consultants may merely reject the contractor's proposals for construction giving neither reasons nor alternative solutions, on grounds that his role is merely to check. The process can be protracted and will cause delays and severe damage to the delivery. Close cooperation and interaction between participating parties in the project must be the utmost strategy.

Other personnel issues that need to be addressed may be as follows;

1. ***Different background, values and goals.*** There is a need to inculcate a sense of achievement among the members. Some may report for duty merely to get the monthly salary and annual increment. Assess their motivation early for early surgery.
2. ***Set values need to be revolutionised to allow innovations.*** Most professionals are familiar and trained along the traditional design-bid-build approach and are unable to demarcate the line of professional responsibility, limiting innovations and value engineering.

3. **Identify leadership of team members.** Assigning leaders can lead to poor productivity due to misjudgement of the quality of the personnel. Certain individuals cherish being the leader, but are unable to command the tasks of delivering. It requires skill in management, human resource mobilisation and respect.
4. **Willingness to be accountable for actions.** How often have we come across situations where it is difficult to find anyone who is willing to take the rap for mistakes? The tracking of events and actions is very important for the team leader or manager to prepare the company for any potential litigation and claims.
5. **Establish a clear line and methods of communication.** Poor communication system can lead to lengthy debate and discussions for the simplest issue. The leader or chairman of the meeting must be skilful to alleviate this.
6. **Fitting proper and qualified people in the right box.** We may have a perfect organisational structure but not the personnel to commensurate accordingly. The organisation will break down rapidly if the conduct of the personnel is suspect.
7. **Intelligent use of relevant information.** Sensitive information such as costs, remuneration, claims, tender awards, etc. must be handled carefully by selected personnel to avoid misunderstanding and/or espionage.
8. **A united front,** as the goal can be impaired by a few who are not team players.

## CONFLICT OF INTEREST

Being engaged by the contractor to deliver the buildings that the architect designs and supervises raises the issue of impartiality on the conduct of the architect and any of the consultants involved with the project. Here also lies the test as to whether this system of procurement is feasible or otherwise. It must be emphasised that the crucial issue that determines the success of a design and build procurement contract is “honour” on the part of all participants. The consultants are bound by their respective codes of conducts, rules and building by-laws. To compromise on any of these provisions shall impact upon the credibility of their professional conduct. There are instances where the consultants are called upon to adjudicate on the suitability of materials, methods of construction and standards that are questioned by the client. The sound professional judgment of the consultants should be the finality unless the credibility of the consultants themselves are being questioned for which their services should be terminated or arbitrated.

Client agencies are prudently advised to nominate experienced and credible consultants to avoid doubts and misunderstanding. Similarly the credibility and track record of the contractor should also be scrutinised before their appointment. It is not an excuse for consultants to compromise their conduct on grounds that the main contractor is their client and pay master. They are ultimately professionally responsible to the principal employer and end users. Disputes are usually attributed to the varying interpretation of the contractual obligations by the contractor and the client’s agents or project managers (PMC). PMC’s are also manned by professional consultants who serve as enforcers of the contract. The attitude and spirit of the team must be one of ensuring compliance to acceptable or best practice to achieve a not only fit for purpose buildings but also the design intent of acceptable quality. Therefore, every consultants who participates in the decision making process during the execution of the works must be totally proficient in the methods and processes of construction as discussed above.

## CONCLUSION

Design and build is certainly gaining momentum as an alternative project procurement and delivery system. In the US the system has outgrown the traditional design-bid-build method. This is spurred by the need for innovation, speed and cost effectiveness in project delivery. It has encouraged the shift for an integrated approach in design where construction technologies are essential components. It not only offers the building owner a cost effective scheme, but also a single point responsibility on the part of the builder. In some cases the building owner is part of the building team monitoring the progress and making necessary adjustment decisions to reduce costs and/or enhance performance and functionality. There is a wide scope for the owner to be a participant in the value engineer-

ing process and account for better result.

The current apprehension against the Design/build for the traditional method is due to unfamiliarity with the process. The parties involved need to change their mind-set and attitude, to work as a united team and allow innovations in management and technology to take centre stage. We have to accept that we are always learning and new developments in the industry are introduced constantly. Only then can we react spontaneously to rapidly changing conditions, which are common in construction.

Dato Sri Ar Esa Mohamed  
21stJuly 2010

## ARCHITECTURAL PRACTICE DIALOG : CASE STUDIES

### INTRODUCTION

The volatile nature of the construction industry is affecting the traditional role of the architects and other consultants. Building contractors have no alternatives but to be better organised to undertake large and complex projects, while clients/users are demanding performance and completion guarantees for proper delivery. Contractors are becoming more litigious and claims conscious now than ever before. They are also better-managed and manned with qualified personnel and technicians including quality surveyors, engineers and even architects.

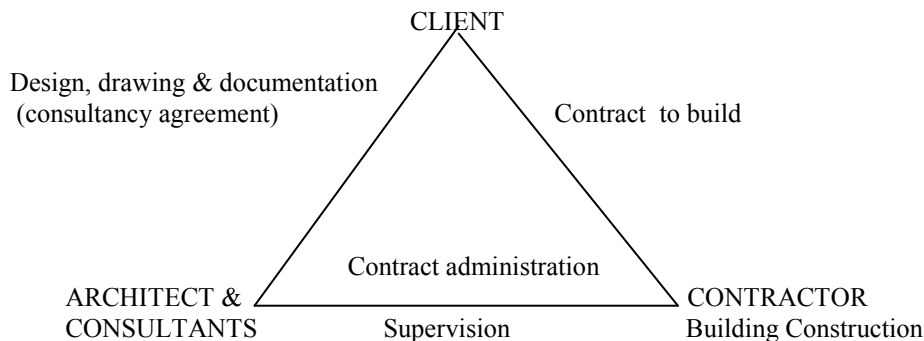
Architects who are traditionally revered as the professional who protects the clients' interest and against unscrupulous doings of the contractor are now marginalised for their own weaknesses in handling the complexities of contract administrations. The late Oscar winning actor, Charleston Heston once said that "the trouble with the movie business is that it is art and the trouble with art is that it is business!" The same goes with architecture. You want to make a mark in your creation, but how do you realize it with the varying demands of clients, authorities, contractors, end users, the public at large and most importantly sustaining your existence?

It is not surprising that in some of us architects, are willing to forsake our principal role by allowing others to assume that important role of contract manager and which actually determines the delivery of the project as well as controlling its costs. In order for us to remain in control of the delivery process, we need to hone our knowledge and enhance our capabilities to be above them and to command respect as the lead professional in the construction and building business. It is imperative that we need to consider the various approaches to the delivery and procurement system that are being practiced currently. This presentation will explore the process touching on the Design and Build system, quality procedure and office management.

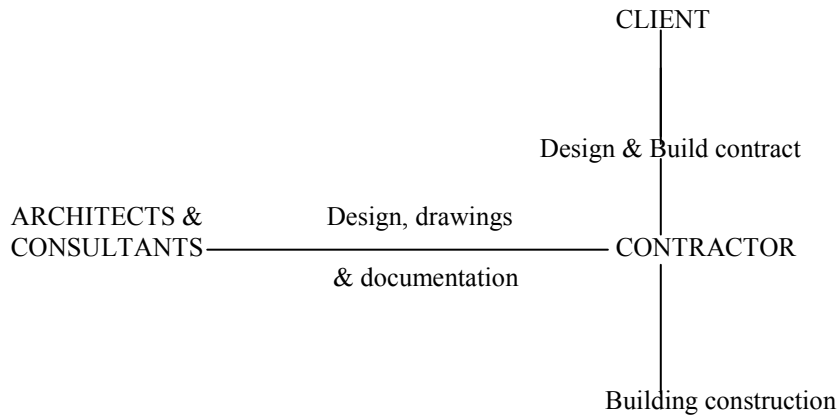
### DESIGN AND BUILD

There is now a growing school of thought that perhaps the project delivery would be more efficient if there is a "single point responsibility" through a "design and build" method of procurement as opposed to "design-bid-build" which is the traditional method as shown below.

### DESIGN-BID-BUILD



## DESIGN & BUILD



Client bodies are finding it onerous to deal with complex, technical and legal issues in the delivery of projects and having to deal with separate consultants of varying disciplines and cultures. If the client has to deal with the interfacing of all these disciplines it would defeat the purpose of having the consultants in the first place. Invariably, they have to engage a project manager to oversee and manage the consultants.

Architects claim that by their training and scope of services include the coordination and management of the other consultants work. In practice, it is difficult to expect the other consultants to perform under the architect when they are financially beholden to the client directly, no matter what the conditions of engagement says. This maybe further exacerbated by the architect's own weaknesses of not being able to deliver their part of the works, be it drawings, details and management abilities. How many times have we heard of complaints of shoddy workmanship and architects try to defend themselves by pointing their fingers at the contractors? After all contractors nowadays are chosen by the client. So why should the superintendent architects be responsible if the contractors refuse to listen. Unfortunately, this is no excuse for bad product and delivery.

We have to explore other avenues and innovations to ensure that the delivery of products meet to our expectations and standards. To me, the current state of affairs in the building delivery system is working against the architects and consultants. We are paid miserably and are expected to be accountable to everyone, the client/ developers, the public and purchasers, the end users the authorities and it is forever. It is a raw deal and no one appreciates us.

### **CHANGING THE MIND-SET**

While we are griping about how unfair the industry is to us architects, the client bodies are also complaining that they are not getting the services they expect from us. For one thing is certain, the industry is getting more sophisticated where projects are getting more complex. Architects cannot claim to be the expert in the diversity of project types. So clients are looking for safer alternatives than the conventional procurement method.

We are familiar with the "turnkey" method of delivery or procurement to overcome the pitfalls in the traditional design/bid/build system. This method is widely used by Government in infrastructure and building projects. With the introduction of privatisation in the mid-80's, turnkey system have become more and more complex with the intro-

duction of the BOT (Build-operate-transfer), Deferred payment contracts, management consultancy and D & B (Design & Build). Under the current administration, the Private Finance Initiative (PFI), BLT (Build-lease-transfer) is the model that is favoured by the Economic Planning Unit of the Prime Ministers Department. Unit Kerjasama Awam dan Swasta (UKAS) was set up to deal with BLT contracts. One can see the lesser emphasis on the role of consultant architects as the lead player in the delivery system. Clients are not able to maximize their business objectives by merely adhering to the architect's lofty design ideals. The engineers on the other hand can offer alternative engineering solutions that can be cost effective as well as meet the functions and fit for purpose. They have saved a lot of money for the clients through their value engineering, which is becoming the lexicon of the building industry. The financial engineers play major part in structuring the project implementation to ensure sustainable returns over the lease period. The principal player is the entrepreneur/businessman who may not have any professional training on technical expertise, but sheer guts to take risks. However, the risks taken are well calculated and supported by the army of professionals employed in the organisation whether in house or as consultants to undertake risk assessments and management.

So it depends on where you are as the architects in the hierarchy so as to exert influence over the delivery system. I personally believe that architects should lead the industry as what traditionally they are known for. We must restore this role, which is being eroded by our own shortcomings of not wanting to venture beyond our traditional box. My personal experience in this arena has been difficult and gradual. The first step is to understand risk and cultivate entrepreneurship. This is not as simple as it sounds for it can hurt and may even make you loose everything. So you have to do a thorough evaluation and prepare yourselves. To me, it is a necessity so as to understand the market and respond accordingly.

## **GETTING STARTED**

As consultants, we have never been exposed to catastrophic risks as businessmen. We just receive the aftermaths. We sell our services and adopt codes and procedures to avert risks and get paid. Of course, the profits we get are nowhere close to the margins that the entrepreneur makes. However, this should not be the only motivation for you to change. In the D & B, it offers the architects the opportunity to take better control over the design by having greater involvement in the construction. So there must be a tacit understanding and a common mission must be established between the architects and contractors as a team to deliver the designed product. This is not easy as conflicts of objectives and interest of the two disciplines will occur. It can be resolved through clear procedures and management. I have found that the major weaknesses as consultants is our inability to be flexible to the needs of contractors who at most times appear to be fickle and indecisive. Now, this is actually the hazard of the job where varying conditions give rise to varying solutions at the site. Unpredictable weather can change the construction approach and hence the design.

As normal consultants, we will not tolerate endless changes, as we are not willing to take the risk of incurring costs for abortive works. To minimise these abortive works, we have to anticipate the various problems before they actually occur. Most of the times, it is not that simple. What I have done now is to allow some costs to this element while improving the production process by ensuring that the problems and needs of end users are completely resolved before finalisation of documents.

As in any commission, you have to establish the "need statement" and terms of reference for the project. In the case of Government projects, it will be in a form of a bid-document outlining the contractual conditions and specific brief of requirements. These projects could be schools, colleges, universities, hospitals and other public buildings. You must have acquired sufficient experience and skills in these specialised projects to be able to arrive at an acceptable proposal, which can be considered by the Government. The interaction between the consultants team and the contractors costing team will be intensive with both sides taking certain risks in their own areas. The team leader will need to motivate everyone on the big picture to be successful in the bid. The team now is a multi-disciplinary and multi-tiered project team. At this point, the only mission is to win the project. Just like in any competition, should the team succeed, and then there is already some hope of cohesion in the team to see the project delivery.

Hence the success of the D & B firm is the formidable organisational structure of the team. Admittedly in most cases, the team members come from various firms and disciplines, which have to be consolidated for the singular project. So you have to formulate a clear management organisation to provide clear lines of communication and

responsibilities. The good attributes are ; -

- Good communication
- Common goal
- Responsible autonomy & authority
- Accountability
- Trustworthiness
- Diligent and innovative
- Self-critical
- Team-player
- Leadership

## **CASE STUDIES**

In the case of KLIA, we formed the consortium Malaysian Japanese Airport Consortium Sdn Bhd (MJAC) to undertake the Design Development, preparation of Design and Build tender packages, Design Management and Construction Management for the Passenger Terminal Complex. The challenge in this job was, first of all, to bring a diversity of cultures and nationalities together under one roof. We had three local consultancy firms and two Japanese firms combined to form a consortium to undertake the work. In my firm, I had already about 30 expatriate British employees who were specifically engaged for the project. We had to agree among ourselves on the split of responsibilities and fees before presenting ourselves as a single entity to the client, KLIAB, to negotiate the fees and the scope of services. It was a protracted affair clouded by suspicion and covert negotiations. What I learnt was to take control of the team through shares. The Malaysian Japanese Airport Consortium (MJAC) comprised of Perunding Lapangan Terbang Sdn Bhd (PLT) (60%) and Pacific International Consultants(PCI)/Kisho Kurokawa Assoc(KKA) (40%). In PLT Akitek Jururancang (M) Sdn Bhd is the majority shareholder. So I positioned myself to be in control of the Board to determine policies and negotiation with the client. Then the control of the organisation and management structures became almost automatic. A total of 12,400 man-month was deployed out of which the local took about 10,000 man-months.

The management mission was based solely on the promised terms of reference which was spelt out in great detail for each of the executives whether locals or foreign. The number of personnel had to be agreed by both the members of the consortium and the client including their nationalities. Very clear lines of communication were established including demarcation of responsibilities for every aspect of the projects.

I found that the obstacles to the smooth implementation were initially the different values, goals and disciplines of the various nationalities and background. Our Japanese consultants appear to be more sympathetic to the Japanese contractors. Our British consultants followed strictly the provision of the contract and specification without compromise, which finally prevailed. Other obstacles were;

- End users indecision causing delays in design freeze
- Interfacing Issues with regard to the various works packages
- Committed leadership
- Getting everyone to be a team player
- Document tracking
- Collocation, ie movement of personnel to an isolated site

These obstacles had to be overcome by instituting appropriate management systems using IT for almost every aspects ranging from human resource, finance, quality assurance and document control.

Unlike the KLIA, the Mid Valley City Project exposed AJM to the true Design/Build method of delivery. In KLIA, AJM through MJAC was the Design and Construction Manager to supervise, on behalf of the client, the works by the D/B Contractors who engaged their own consultants to prepare shop drawings and construction drawings for our perusal and approvals before they are executed. In MVC, our engagement as consultants was novated to the contractor. This was made possible, as the contractor was the client's construction arm. We prepared the construction drawings and contract packages for the main contractor who had been given the mandate by the client to deliver on time and at optimal costs. The contractor also had a parallel team of architects and engineers to oversee the

project. Naturally and sadly, design was compromised along the way to meet the cost targets of the contractor/client. The consultants' input was construction driven and we had to negotiate with the contractor to realise our design intent as much as possible.

Another example is perhaps my most satisfying, the Sungai Buloh Hospital and College of Allied Sciences. This was the first Design and Build project where I performed the task of design, procurement and construction. It took a lot of energy, resources, funding and lobbying to secure and deliver the project. It was completed on time and operational. The college was completed on year ahead of schedule. The cost of construction as advised by the Quantity Surveyors cannot be the basis for determining the true cost of works. Prices that you get from works contractors, suppliers and manufacturers vary to as high as 50% depending on how sharp you are in timing and negotiation. The procurement department must have a rich data base of prices for building materials, suppliers, installers and workers. So inexperience in sourcing materials and labour at the right price will cause a good contract to run into financial difficulties.

Since the Sungai Buloh Hospital project, we have implemented two additional projects on the Design and Build contract; UiTM Medical Research Centre and the University Malaysia Pahang. Both these projects were completed on time. We are working hard to secure our first BLT project in the near future.

To smoothen your works, you will require the backing of a good banker to ease your cashflow in anticipation of slower payment procedure and unexpected glitches in your construction schedule. The mixture of financial instruments must be tailored to your construction needs, which maybe in the form of overdrafts, term loans, letters of credit, bankers acceptance, trust receipts or revolving credits and performance guarantees. The cost of these facilities must be imputed in your cashflow so that you will not find yourself short during the construction. The eminent role of the financier cannot be underestimated in construction financing. Usually the amount attributed to them will impact the project cash flow. Tight management of financing is also related to the management of the project progress. Bad workmanship, abortive works and variations will have adverse effects on the construction finance which will snowball to failure.

## **CLOSING**

Design & Build, BLT, BOT contracts, etc are going to change the mindset of project developers and client bodies. They present new possibilities with the advantages of;

Single point responsibility

Simplifying risk management

Relieving owners of coordination responsibility

Developing unity amongst; clients, authorities, architects, engineers, contractors, suppliers and other players.

Better control on the design

As architects, the professional obligations and responsibility remain unchanged except when they are directly involved as promoter or shareholder of the contractors' firm where commercial risk will be inevitable. To me, this is a window of opportunity for architects to venture beyond their traditional role and territory. It is exciting and challenging but not for the faint-hearted. The current dynamic global environment calls for innovative methods of project delivery. We have to adapt to varying conditions, statutory provisions and regulations in the various parts of the world where we want to practice. Liberalisation of services also requires liberal approaches to practice. We cannot be left behind by the more aggressive foreign consultants. We have to be likewise.

Presented by;

Dato Sri Ar Hj. Esa Hj. Mohamed

For PAM Practice Dialog

21st July 2010