DECISION MAKING APPROACHES IN PROJECT MANAGEMENT: A STUDY IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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Introduction

It was May 1992; Jamilus Hussien, had been given 24-hour notice to report for duty to head the new airport task force that was the KL International Airport (KLIA). The Public Works Department engineer was overwhelmed.

> "I had managed million ringgit projects, but to be summoned overnight for a multi-billion ringgit project floored me…."

The Government allocated one billion ringgit for initial start-up costs that included land acquisition for the replacement airport in Sepang. The responsibility was assigned to KL International Airport Berhad (KLIAB), a newly formed wholly government-owned entity under the Minister of Finance Incorporated and Jamilus Hussein as the Managing Director. The rest of the task force had similar directives, and were thrown into the deep end to evaluate a project that had no precedence in Malaysia. Normally this kind of project will take 10 to12 years. Apparently, the biggest challenge for KLIAB was the deadline. The urgency to have the airport built by 1998 required innovative strategies to manage the project.

KLIAB: The Background

Initially, the role of KLIAB was limited to project management, overseeing a consortium of Japanese and British consultants and contractors called the Anglo Japanese Airport Consortium, appointed to develop and construct the airport. A consortium of four companies was instructed by the Malaysian government to create a master plan for the new international airport. The Anglo-Japanese Airport Consortium (AJAC) comprised of Balfour Beatty, Trafalgar House, GEC Marconi and Marubeni Corporation. AJAC engaged several foreign and local experts including the practice

Arkitek Jururancang, led by Hj Esa Bin Hj Mohamed, an architect and master planner who later took on the role of the Chairman of AJAC (Kara, 2007).

The Malaysian government and AJAC decided that the design architect for the main terminal
– the primary element of the airport – should be selected through an international competition. One Japanese and four British architects were invited to submit proposals and presentations were held in London at the end of April 1992. Kisho Kurokawa's concept of a 'symbiosis between architecture and the forest' secured the commission. Work began with the local architect and master plan team in May 1992.

On the 1st August 1992, led by Jamilus, KLIAB group comprised senior government officials formed the task force called the KLIA Project Management Group. The multidisciplinary group from different government departments and agencies gathered in makeshift premises to pore over submissions made by the master plan consultants. They formed the nucleus of the task force that evolved to become the 400-strong KLIAB in 1992.

It was a sharp learning curve for the task force, which first reviewed the KLIA Masterplan and then the Project Definition and Engineering Design Proposal (PEDP), both prepared by AJAC. The PEDP culminated in the Engineering Design Contract, which laid the foundation for the fast-track KLIA project by identifying core activities that must be carried out in advance for the new airport to meet its operational deadline. Subsequently, a fall-out with AJAC ended with KLIAB being thrust into the leading role of developing and building the thoroughly modern world class airport. From then on there was no turning back for the fledgling company entrusted to steer the fast-track airport project to successful completion within six years.

Funding for the International Airport

The decision to build the airport was made in 1991 and the Master Plan and Environmental Impact studies undertaken almost immediately. From then on, it was a case of all systems go, with diverse number of activities proceeding concurrently in

the fast-track infrastructure project that owed much of it success to the timely availability of funds.

The opening day cost of the first phase of KLIA was estimated at RM9 billion to be spent over six years. The Government had allocated RM1 billion from the Federal budget for land acquisition, upgrading of roads to meet traffic requirements, water supply, consultancy fees and equity in KLIAB (RM200 million). The rest of the ringgit was to be raised from the private sector.

Fortunately, the booming Malaysian economy helped, with the country averaging a high growth rate of 8% between 1991 and 1995. Given the strong support for the project from Federal Government (which provides necessary guarantees), there was overwhelming support from the domestic financial community. International funding was limited to a Japanese Overseas Economic Cooperation Fund (OECF) that approved a loan for the part payment of the main terminal building, contact pier and the baggage handling system. Although the OECF provided for a 61.5 billion yen loan, KLIAB limited its borrowings to 29 billion yen due to unfavourable foreign exchange conditions.

On hindsight, restricted foreign borrowings proved to be KLIAB's single biggest blessing in the light of the fall of the ringgit in the economic crisis that swept through the region since mid 1997. It is also fortunate that the airport was nearing completion at the time of the economic slowdown that resulted in spiralling interest rates. KLIA was not affected by this.

For the first two years, KLIAB obtained funds to meet its development expenditure from institutions such as the employees Provident Fund (EPF), Pensions Trust Fund, Social Security Organisation (SOCSO) and the Pilgrims Fund Board (Lembaga Tabung Haji). In 1995, bonds worth RM1.6 billion were issued by them and a RM 500 million revolving loan facility provided by Affin Discount Berhad. Another RM2.5 billion term loan was approved by the EPF in 1997.

Meanwhile, in late 1995, the Federal government decided to include Islamic financing in bids from bankers. KLIAB gained access to Islamic funds from investors

who readily welcomed the opportunity in a market characterised by a dearth of Islamic securities. The largest single of RM2.2 billion A-Bai Bithamaan Ajil (BBA) notes by Bank Islam in January 1996 was followed by another RM2.2 billion BBA notes in1997. Islamic funding utilised by the KLIA project is a world record. KLIAB also has the distinction of being the first company to float its Islamic notes on the Scripless Securities Trading System.

Managing the project

In managing mega projects, time is a luxury one could not afford. With time as one of the core objectives of a project, even a simple project may become more complex to deliver. For a mega project, the bigger the scale and size of the project the more complex the work processes gets and a slight delay in one component of the project will have an exponential knock-on effect to the other project components. Acknowledging the strategic significance of the airport to the Malaysian economy and the impending 1998 Commonwealth Games in Kuala Lumpur, KLIAB deemed necessary a sound procurement strategy that prioritised fast-track methods.

The foundation for fast-tracking was laid by the Engineering Design Contract, and out of this grew the KLIA Master Implementation Programme, the cornerstone of the procurement strategy, for the full development of KLIA. Described as "one of the most difficult tasks that KLIAB had to perform in 1994", the time-driven Master Implementation Programme organised all construction activities into a systematic framework of realistic timelines, with a target 1998 deadline.

The KLIA project include of 6 general phases (Figure 1) that comprised of more than 100 facilities divided into eight distinct groups of construction packages: passenger terminal complex; runways and aprons; earthworks and drainage; perimeter roads; central terminal area; southern support area; air traffic services; and utilities.

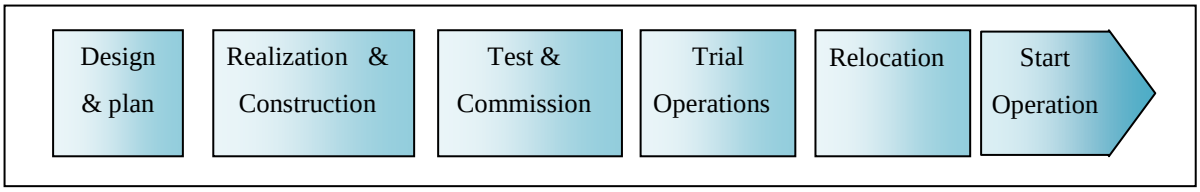

Figure 1: General Phases from Investment to Operations of KLIA

Eighteen consulting organizations were appointed to assist the KLIAB in managing the KLIA project. Even a little conflict between parties or delay in work resulted in tremendous negative impact to the whole project schedule and made the project co-ordination and management more complex.

KLIA's procurement strategy revolved around a selective combination of fast track design-and-build and conventional fast-track methods. This strategy fitted well into yet another strategy that divided the entire project into three manageable graphical areas – passenger terminal complex, core facilities and privatised facilities. The work contracts were broken into packages according to their respective areas. Three types of contracts were awarded:

- Fast track conventional tenders
- Fast track design and build tenders
- Conventional tenders

For the fast-track design and build and conventional contracts, tenders were invited based on preliminary engineering and architectural designs, with enough information for contractors to tender. Successful contractors were then issued just-in-time working drawing during the construction stage. Competitive tendering and just-in-time fast tracking approach eventually saved KLIAB a great deal of time in getting contractors to begin work on site (Figure 2).

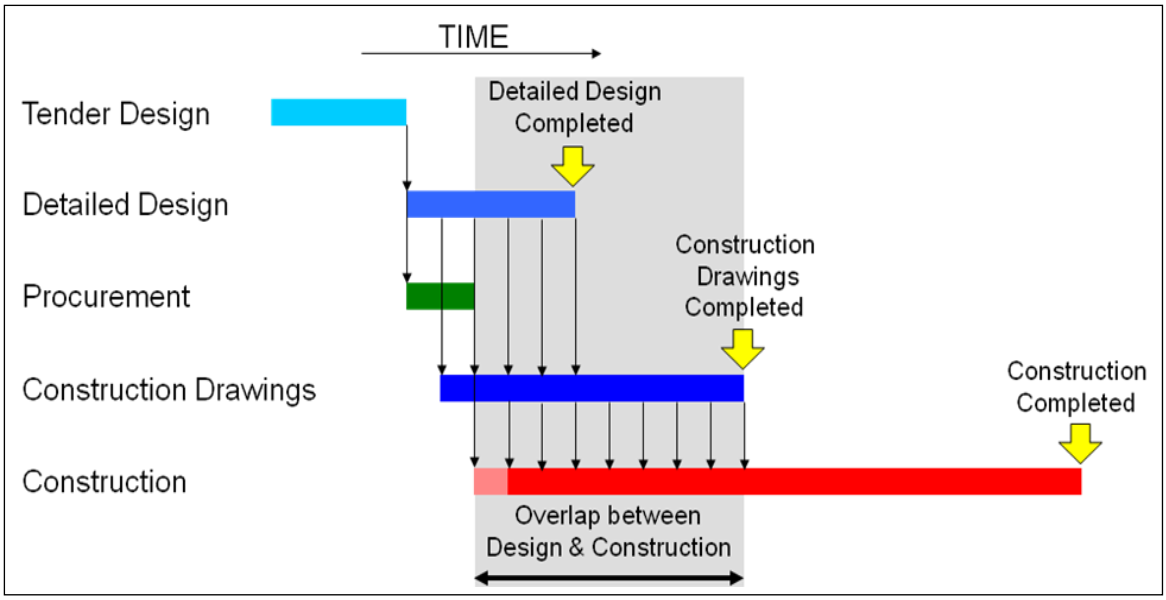

Figure 2: KLIA Fast Track Implementation

The procurement and contract package distribution strategies (Figure 3) in turn created yet another challenge: interfacing between numerous work activities and contractual overlapping. In response, KLIAB developed an innovative management matrix that took into account the complex planning, monitoring and control functions of managing a project of this scale and pace. KLIAB had braved into uncharted territory, trailblazing an organisational management structure that created another first in Malaysian construction history. Jamilus Hussien, who was responsible for the planning, design and construction of the KLIA project said.

'In the development of KLIA project, the decision making process is the key, from bottom up and top down. How do you manage cost, time, quality, and information from top to bottom and bottom to top? It is all about the money. Changing scope is money, technical requirement, time delay, the policy level is money level change."

"There must be change level meeting; the lowest level is the package level, then areas, then overall, then the policy level. The cycle can be daily, weekly or monthly to manage the information. Decisions were made according to the level. . From my experience almost 80% of problem were solved at package level, 15% at area level and 5% overall before it goes to policy level'

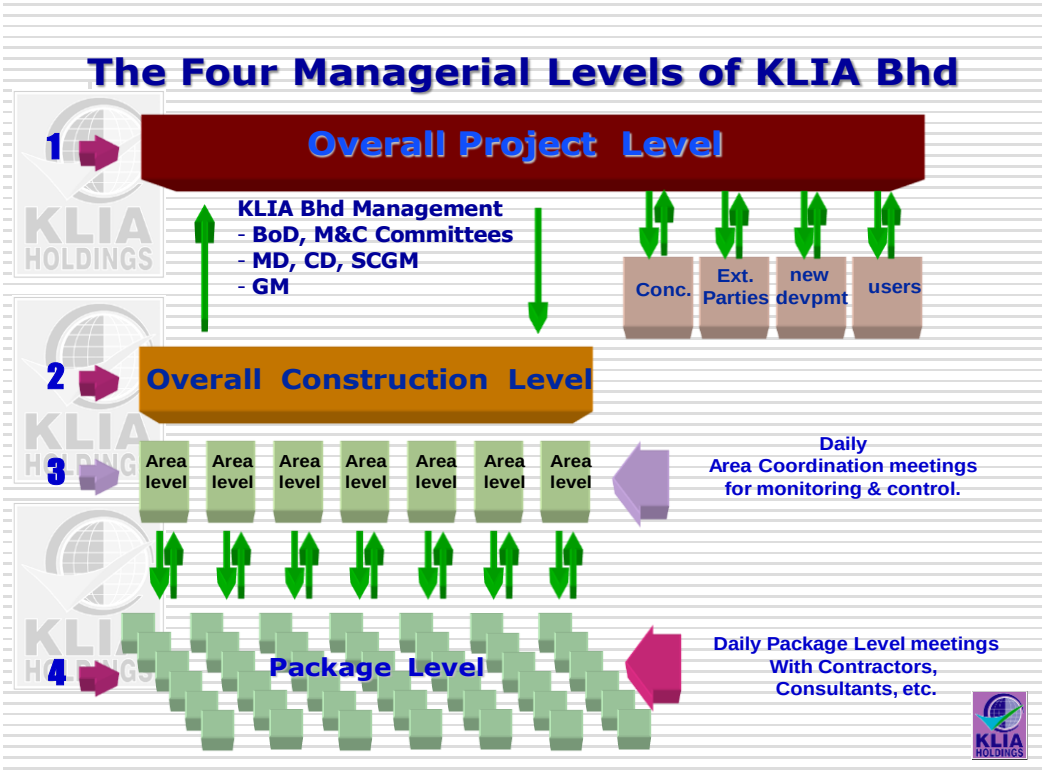

Figure 3: The packaging concept

The management matrix was driven and controlled by inter-supporting project units and service units. The efficient and smooth flow of information between the executive levels, project and service units through a close-looped approach facilitated quick decision-making and conflict resolution. To optimise productivity of specialist skills, KLIAB's organisational resources approach was to form a core team of highly experienced and committed professionals supported by external consultants. Local and foreign planning, design and supervisory consultants were engaged to provide relevant expertise and services. Together, they adapted existing or developed new management tools to monitor and control time, cost, quality, and more importantly, fostered a professional working culture and a unique spirit of partnership.

The closed loop is a tool used to execute various project strategies implemented earlier on (Figure 4). It is also a communication tool, ensuring the clear and well-defined flow of information, which is critical in managing large scale project.

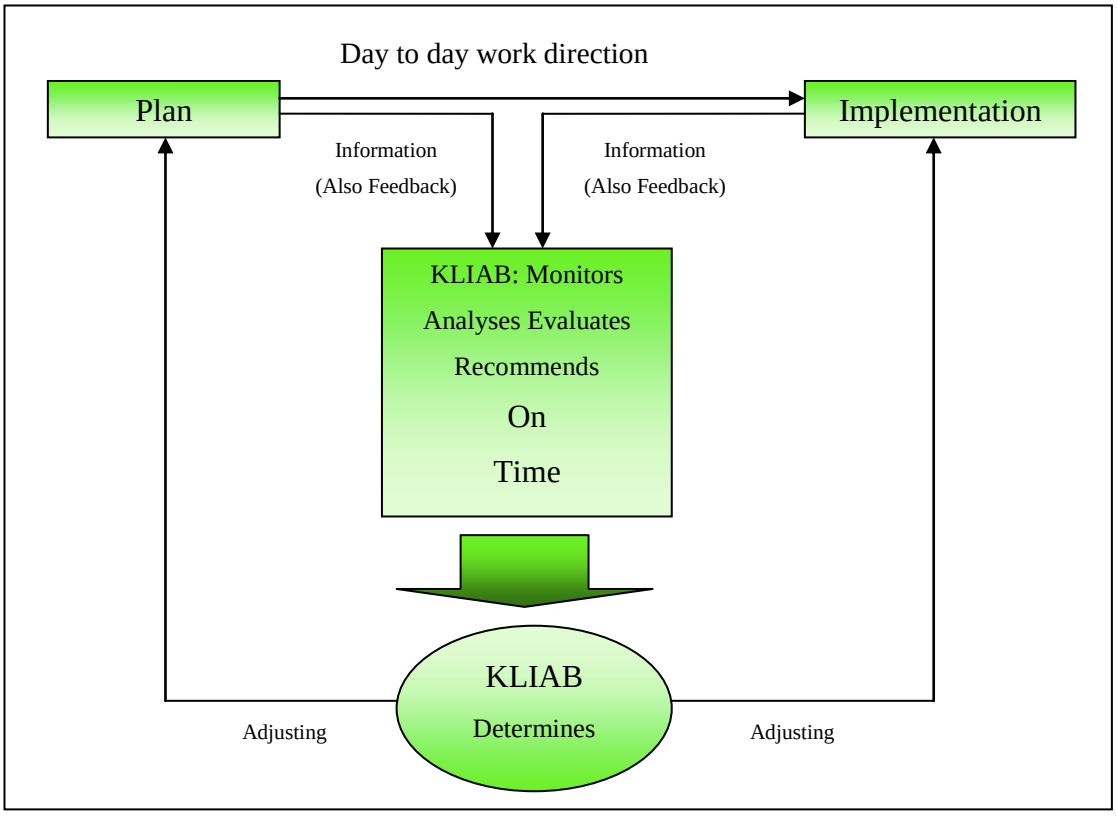

Figure 4: Concept on Closed Loop Management Approach

The implementation of ISO 9000

KLIA (Kuala Lumpur International Airport), which implemented ISO quality system right from the early period of the project. It was a great challenge for the KLIA Construction Management Team to implement the ISO quality system in a large project, which involved nearly 150 major contracts with more than 110 major contractors and 1600 interfaces between participants. According to Hakim (2000) the QMS plan implemented in the KLIA project was referred to as Project Quality Plan (PQP). The critical quality elements were: 1) management responsibility; 2) quality planning; 3) resources management; 4) process control; 5) inspection and testing; 6) quality recording; 7) auditing; and 8) data analysis and report.

KLIAB produced a detailed QMS (Quality Management System) including the PQP (Project Quality Plan) whilst all the supervisory consultants and the contractors produced their own quality plans and submitted to the KLIAB. The elements contained in the quality plans were used as minimum requirements for the implementation of the QMS against which the consultants and the contractors were assessed for the extent of their conformance.

At the initial stage of the construction phase, i.e. in 1995, the contractors were naïve on the implementation of the QMS. Most of the contractors did not submit the quality plan for KLIAB's approval even though it was clearly indicated in the agreement. Without this key document it was impossible to implement the QMS. Some of the quality plans submitted were incomplete and therefore were not approved by KLIAB. Consequently, many works did not meet the Contracts and KLIAB's requirements. The consultants frequently issued the Non Conformance Requirements (NCR) to the contractors for the failure and non-compliance with the stipulated QMS procedures. For instance, in June 1995, the consultants issued eleven NCRs to the contractors due to their ignorance of the procedures and in November 1995, an average of thirty Notices of Deviation (NOD) was issued to the respective contractors.

In 1996, the contractors were becoming aware of the importance of QMS and started to give attention to relevant procedures. Most of the contractors had submitted their comprehensive quality plans, and gained approval for the plan from KLIAB. At

this stage the contractors faced several challenges to materialise the quality requirements into reality. The analysis of the contractors' performance of this particular year shows that they were having difficulties to implement the QMS in practice. The NCR and NOD reports of the concerned year indicated that the several problems such as non-conformance with the quality plan procedures; the records of work were inconsistent with the work executed on site, and non-compliance with the stipulated specification still prevailed.

In spite of the inconsistency, the efforts shown by the contractors to fulfil the quality requirements were regarded as a positive development as they began to learn and understand the needs of implementing the QMS. The main contributing factor to the improved performance of the contractors was the training offered by the KLIAB. To ensure the continuous improvement of the contractors' performance, KLIAB worked and monitored the progress closely with the contractors. In 1997, the contractors' performance was much better. They began to implement most of the quality plan procedures. There remained however several deficiencies to be remedied such as non-compliance to certain procedures, poor documentation on the implementation of certain procedures and a great number of NCRs.

The contractors were continually learning the implementation of the QMS. They were undergoing a change process from the traditional methods of managing their construction works to an efficient and systematic way through the QMS. The contractors could not be blamed solely for the shortcomings as they had no prior experience in implementing the QMS and it was comparatively new as well to the construction industry in Malaysia.

Similar to the contractors, the performance of the consultants was evaluated using the requirements contained in their approved quality plan. In the first half of 1995, only one requirement was complied by the consultants; i.e. checking the contractors' method statement and testing procedures. The consultants were inexperienced in implementing the QMS and had similar difficulties as the contractors in adopting a new system of supervising construction works. The consultants reacted positively however, to improve the situation.

In the second half of 1995 they started to fulfil all the requirements by beginning to develop the procedures but as the construction work commenced, a lot of works were done without proper auditing and checking. Auditing of the contractors' work was inconsistent; as a result, construction works were not able to be efficiently evaluated to check for the conformance of the specified requirements. Documentation systems were not properly exercised including the critical activities such as procedures for testing materials, which resulted in difficulty in checking the reference and controlling the documents. The shortcomings of the consultants had a negative impact on the total implementation of the QMS.

In 1997, the working culture of the consultants towards the QMS had changed significantly. Their works were in accordance with their quality plans. Auditing against the contractors' works was undertaken properly. Despite the outstanding performance, there were some minor drawbacks such as poor documentation. Even though these minor drawbacks were negligible but they were fairly important to consistently achieve high quality at work. The key lesson is that it is imperative to train the consultants before they begin supervising the contractors' works because they are the critical agents to ensure the success of the implementation of the QMS.

As a leader of the project, the KLIAB produced its quality manual before the commencement of the construction phase. The elements contained in KLIAB's quality plan were clear definition of the project; structure of the organisation; the responsibility of each management level; the process involved; necessary resources; implementation procedures; and methods to ensure implementation and project control.

KLIAB had exercised all procedures stated in its quality plan, including documenting processes and procedures, auditing against the consultants, and verifying the audit done by the consultants against the contractors. Several faults, weaknesses and unnecessary procedures had been identified through this process and corrective measures were applied according to the procedures stated in the quality plan. To improve the performance of the parties, the KLIAB conducted training through a series of conferences, seminars, workshops and meetings. The purpose of the training was to educate the consultants and the contractors to appreciate the importance of the

QMS, to clarify their function and the responsibility, and to guide them towards effective ways of conducting audits. The training given by KLIAB boosted the level of understanding of the consultants and the contractors on the implementation of the QMS and changed their working culture.

Constructing the Project

The choice of site for the airport reflected the perceived need for decentralisation to spread growth beyond Kuala Lumpur and the Klang Valley. Sepang was chosen after considering a total of eight sites, primarily because:

- It was a sparsely populated greenfield site
- The relatively flat terrain met aeronautical requirements
- It was 50 kilometres south from Kuala Lumpur (45 minutes by road)
- It was strategically located in relation to high-growth areas
- The cost of acquiring land and resettling local residents was minimal
- It could serve as a catalyst for growth, with minimum adverse effect on the community and the environment

Relocating Communities

The site identified for KLIA comprised a few sleepy settlements lost amidst rolling hills of rubber and palm oil plantations. A small community of 85 orang asli (aborigines) families was living there. They were mainly smallholders cultivating rubber, durians and other tropical fruits on their 891-acre settlement. They had to be moved. However relocating communities is not easy. KLIAB sought the assistance of the Aborigines' Affairs Department (Jabatan Hal Ehwal Orang Asli) to make their relocation as painless as possible.

To ensure that the orang asli would enjoy a better life in their new village, the Federal Government had to work through the traditional *orang asli* hierarchy and took several measures. They were compensated for their loss of land, with some families receiving up to RM100, 000. To help them spend their compensation wisely, the Aborigines; Affair Department conducted meetings (through their headman) on how to invest their money.

The new village was 20km away near Bukit Cheeding Estate. The community settled into their new *kampung*-style homes on a 1000-acre site in 1993. It is a more integrated set-up, with a school, canteen, a community centre, a *surau* and three shop lots. They received government guidance on how to manage business. Meanwhile, Government agriculture agencies such as FELCRA (Federal Land Consolidation and Rehabilitation Authority) stepped in with advice on palm oil cultivation in the newly acquired land. It also introduced the *orang asli* to hydroponics, by constructing a greenhouse to kick start the water-based food cultivation practice.

Another 9900 acres of oil palm and rubber plantations also had to be acquired. The Federal Government bought, wholly or partly, four estates affected by the airport development: Sungai Labu, Lothian, Bute and Sepang. There were a few homes for labourers affected, and plantation owners either served them termination benefits or redeployed them. All up, approximately 120 workers were affected. Several used their termination benefits to buy subsidised low-cost homes in the nearby township of Bandar Baru Salak Tinggi. To meet their needs, an additional 165 double storey terrace homes were built in the township and an extension added to the local school.

The estates and orang asli settlement accounted for approximately 10,700 acres of land. The remaining area belonged to government agencies and a government forest reserve. It added up to 25,000 acres, the area allocated for KLIA. The Federal Government spent altogether RM375 million on land acquisition, compensation and resettlement.

The Transient Workers

Remote construction sites are notorious for hastily built slum settlements of *kongsis* mushrooming overnight. The crammed living quarters often supports more bodies per square meter than Wembley Stadium at the FA Cup final. Coupled with the fact they often do not have piped water, electricity and suffer from badly maintained communal facilities, they health hazards waiting to explode. Cross-culture interactions resulted in contradicting work culture, and language barrier posed many unavoidable problems.

To overcome this problem, KLIAB set out to build a township on a 40-acre site at the edge of the airport where migrant workers could live and work close to the

33 work sites scattered across 25,000 acres. A well-planned town catering to the needs of the KLIA workforce, particularly, manual staff, was considered important in helping alleviate many of the social and health problems associated with *kongsis* and shanty towns the world over. The town was built in 1995. It provided housing, transport, food, community and commercial facilities to a peak-time population of 30, 000 workers from more than 50 countries. The RM 40 million township was managed by a privatised consortium, which was awarded the project under a Build-Operate-Transfer (BOT) arrangement.

The Earthwork

Earthworks are literally the groundwork for construction relay race; it frequently sets the pace of work to come. At KLIA construction of the earthworks platform assumed epic proportions because of the sheer size of site and the speed with which the job had to be completed. The airport site was unprepossessing territory, dense estates of thorny oil palm, rubber trees and swamp vegetation that merge into a seamless curtain of resistance. The first task was to hack an access road through the plantations to reach the construction site.

Overnight, the sleepy hamlet of Sepang was rudely awakened from its blissful existence. The place was overrun by people and machines hitherto unknown to the simple rural folk working the estates or tending their patch of agricultural land. Dump trucks trundled across country roads while compactors and excavators rode on the back of prime movers heading towards the earthworks site. Enterprising villagers rose to the occasion and there was a rash of little business, especially eateries ranging from ramshackle take-aways to coffee shops.

The earthworks platform comprised some 3500 acres hectares of lowland swamp of soft clays capped with thick layer of peat and high ground that was to be cut and used as fill. Planning down the higher elevation involved conventional practices such as soil investigation, cut and fill operation, preparing instrumentation to monitor soil profiles and performance, and the building drainage channels.

The peat swamp, however, posed the biggest challenge. The platform over swampy areas received considerable attention since it would have a serious impact on

the progress and performance of the completed airport. Initially, the most effective design solution proposed involved the removal of all the peat and no more than 5 metres of clay. Where the clay was thicker than 5 metres, million of vertical band drains were to be installed to squeeze out the water more quickly. This would speed up by about 90% soil settlement that would otherwise occur over hundreds of years. The final 10% of soil settlement was expected to occur gradually during the construction period.

But thing changed. Competitive tendering for contracts resulted in significant reduction in costs, allowing KLIAB to examine other cost-effective design solutions. Eventually, it was decided to remove all the peat and clay. Solution 2 was a daunting task, involving excavation of up to 20 metres soft clay. Most difficult were the channels of very soft clay flows that oozed into extensive mudflows, causing equipment to become mired in them. Excavators, precariously perched on embankments pressed on, digging (and subsequently filling) into the waterlogged soils Dump trucks had difficulty gaining access to these sites. Finger roads supported by rafts of oil palm trunks were built using army techniques. This enables the trucks to move closer to the excavators that dug and dumped the soil. Truck then disposed their load at designated tips on the KLIA site. The dumping grounds are now the mounds along the perimeter roads, grassed and landscaped to support the ‘Airport in a forest; forest in an airport’ theme of KLIA.

Material from the higher ground was used as fill and compacted to raise the earthworks platform in 250mm layers to the required level. However the thickness of the fill was up to 30 metres! The main advantage of solution 2 is that it eventually resulted in considerable time savings because there was no need to wait for the clay to consolidate.

This proved desirable given the fast-track nature of the KLIA project, where every activity was time-driven. Earthwork was further complicated by the staggered scheduling of activities. Bulk earthworks for the main site comprised six packages, each with different deadlines. A package was further fine-tuned into a multitude of sections, so that the next wave of construction contractors could move in as each section was completed.

It was like several relay races held at the same time, with the next-in-line contractor anxiously waiting for the baton so he could run his stretch in the shortest possible time. This scheduling of work differed from the conventional scenario, where bulk earthworks have the entire site to themselves before construction begins.

To meet deadlines, armies of excavators, compactors and dump trucks were utilised. The equipment was sourced from a bewildering number of Malaysian suppliers. Word has it that heavy equipment was plentiful as a result of the completion of another major transport infrastructure – the peninsular highway project (PLUS). Machines dotted the landscape, scurrying across the wide expanse of stripped ground like armies of ants.

At the peak in mid-1994, more than 300 excavators and 1500 dump trucks worked through the nights. 130 million cubic metres of earth was removed, with more than a million removed in the first two years.

Going for Green Project Concept

KLIAB was acutely aware that airports have the potential to cause significant pollution if not carefully designed and constructed. While the Sepang site is located away from population centres, the landscape, topography, flora and fauna there would nonetheless be dramatically altered by the development. Every measure therefore had to be taken to reduce the impact of the airport construction and operations on the site and surrounding areas. And action was taken from the very start.

At the time the KLIA Master plan was being prepared in 1992, an Environmental Impact Assessment (EIA) Study was undertaken, in compliance with the Department of Environment (DOE) regulations. The comprehensive study examined the existing site and how airport development would impact on air quality, noise levels, land use, landscape, ecology, traffic and transport, infrastructure and utilities and the socio-economic standards of residents in the vicinity.

Also included were mitigation and abatement measures and a environmental management plan for the designated 25,000-acre airport site. The EIA identified the

need for environmental management at two stages namely construction and operation. Developer KLIAB responded by setting up the Health, Safety, Security and Environment Department to coordinate and implement the environmental management plan. It also appointed an independent company to conduct monthly environmental audits.

This move has been lauded by the DOE which acknowledged that KLIAB is the first large project developer to introduce a central coordinating body and environmental audits to ensure contractors observed legal DOE requirements and undertook appropriate abatement/mitigation measures.

The biggest challenge for the new department was to minimise the impact of construction activities on air quality, water quality, traffic management, soil conservation and waste disposal. Given the scale of the project, bulk earthworks caused the air quality index to nosedive. Water and sheeted trucks were widely used to suppress airborne dust emissions.

As a control project, the 10x10 km site met the prerequisite buffer zone that reduced the residual impact of air pollution on surrounding residential areas. Waste soil removed for earthworks was deposited in designated sites that were subsequently landscaped. KLIAB also adopted several imaginative environmentally-friendly practices that have the potential to be benchmarked by other large infrastructural projects, both locally and regionally. The Construction Director of KLIAB, Dato' Ir Hamzah Hassan said:

> 'Some of our initiatives include the appointment of an independent environmental auditor during construction; establishing an aircraft noise monitoring facility for all buildings and facilities; and a continuous and detailed study of bird strike hazards by migratory birds.'

Three balancing ponds were built to prevent flooding and sedimentation. They ensure that stream diversions do not result in flooding and backflow and that water discharged into the rivers is free of construction-generated pollutants.

The removal of vast tracts of vegetation also resulted in turfing and landscaping to prevent soil erosion and flooding whilst enhancing the visual impact of the built area. DOE regulations require 20% of any developed area to be landscaped;

KLIA estimates as much as 35-40% of the built site has been reafforested. The task of creating an instant rainforest at the Passenger Terminal Complex fell on the shoulders of the Forest Research Institute of Malaysia (FRIM). In 1995, it set up a mock rainforest on the airport site as a control area to select species compatible with the airport environment.

KLIAB and FRIM had set up a mock forest at Sepang, where they spent 15 months researching on trees above 5 metres that could survive the airport environment. All up, 300 trees have had a headstart of 15 years and a lifespan of 100 years. There is a generous use of ferns, palms and shrubs to create the four layers that characterise rainforests: emergent trees, main canopy, secondary trees and the forest floor. Water elements such as running streams and a waterfall make the 'forest in the airport' a dynamic habitat.

Balancing Ponds

Three multi-purpose balancing ponds were built in the periphery of the construction site to reduce the impact of surface water pollution. The ponds are both siltation traps and flood-preventers, collecting sediment and run-off, especially during earthworks, which resulted in the extensive removal vegetation. They are also filtration units for water polluted by accidental spillage of oils, grease, fuels and asphalt plants. The filtered water is then released into the catchment area of Sungai Sepang Kecil.

Waste water treatment plant

Effluent from the Terminal Complex will be treated and recycled into water for sanitation and irrigation. The DCS/Co-generation plant uses natural gas, a green fuel, as the primary fuel to produce chilled water to condition all KLIA buildings. Waste steam, a by-product of the process, is used to generate electric back-up power supply for the airport. The use of the centralised cooling system also removes the need for each facility at KLIA to install, maintain and operate its own chillers and cooling towers, causing considerable savings in capital expenditure, energy and operational costs.

KLIA uses computer technology to create a healthy and energy efficient indoor environment. Its Building Management System (TAMS), enables authorised users to adjust air conditioning and lighting levels from any computer terminal. The

airport also boasts one of the healthiest indoor air environments with the installation of electronic air cleaners and carbon dioxide sensors. The efficient filtration of circulating air has two benefits: it provides fresh, healthy air for those in the building; and it saves energy by keeping air conditioning coils clean.

The New International Airport

June 28, 1998, was the KLIA inaugurated date declaring the airport officially opened to commercial operation. Touted as one of the most architecturally beautiful and sophisticated airport in the world, the profoundness of this achievement would be more overwhelming if the following considerations are taken into account;

- A green field 25 million passenger per annum 1st Phase airport development on a generally peat soil, palm oil plantation and secondary forest site,
- Seven-year completion from initiation to site study and selection, Masterplan and Architectural design concept , engineering design, procurement, physical construction, testing and commissioning, and the crucial airport operational readiness and transfer exercise,
- Two years into the project, a sudden fundamental shift in the project's organisational and procurement approach was made – from a contractor-driven design and build turnkey to a client-driven total project management approach,
- 205 different contract packages running concurrently on a 7850 acres 1st Phase development site, with 130 million metres of earth moved; two 1.1 km tunnel BHS connecting tunnel; 200,000 square metres of granite flooring; 18,500 km fibre optic cables laid; 30,000 workers at peak from 50 different countries; to name a few,
- 52 months total construction including testing and commissioning and operational readiness and transfer from the old airport in Subang,
- First ever airport to successfully develop, design and implement a fully integrated IT airport management system,
- No major operational breakdown on opening day except a minor glitch on the baggage handling system (BHS),
- From a submitted estimate of RM20 billion design and build turnkey contract without time completion guarantee, the project estimate was reduced to RM11

billion on the same scope with full commitment on time completion by KLIA Berhad – a newly setup Malaysian run Minister of Finance Inc company given the task to implement the project in late 1993.

Ingredient for Project Success

The major factor for the successful implementation of project management is that the project manager and team become focal point of integrative responsibility' (Kerzner, 1995). In mega project especially, the diversity of the project types, organisational levels, and personnel and worker involved is as diverse as the project scope.

The project manager must be able to exert interpersonal influence in order to lead the project team. The members of functional departments may be accustomed to a single reporting line in a hierarchical structure in a matrix organization, but the project manager coordinates the activities of the team members drawn from functional departments. In general, the project manager's authority must be clearly well defined, particularly in matrix organization where the functional division managers often retain certain authority over the personnel temporarily assigned to a project. The project manager should encourage problem solving rather than role playing of team members drawn from various functional divisions.

Some problems of interaction may arise initially when the team members are unfamiliar with their own roles on the project team. Many major issues in construction project require effective interventions by individuals, groups and organisations. The fundamental challenge is to enhance communication among individuals, groups and organizations. Based on the experience of KLIA project Jamilus emphasized that:

> "The most difficult part in this project is managing people. I got used to having to handle such a costly project, but in managing people there is the element of unpredictability, even irrationality. For human management, there is no general rule"

> "Government servants are well-disciplined and trained to observe procedures and systems. Private sector consultants and contractors, on the other hand, are

focused on getting the job done quickly and willing to take risks, mopping up mistakes as they go along. Then, there are migrant workers, from different parts of the world and different socio-economic backgrounds.

> "KLIA gave them all the opportunity to interact and learn from each other. It certainly did for me…I believe that for everyone involved, this project must surely rate as an important testimonial of his/her ability to work in tandem with different disciplines and cultures to meet a common objective: to build a world class airport according to plan. This is the 'soft' factor that cannot be quantified. It should give us all the winning edge, especially relevant with increasing globalisation in our borderless world."

To optimize productivity of specialist skills, KLIAB's organizational resources approach was to form a core team of highly experienced and committed professionals supported by external consultants. Local and foreign planning, design and supervisory consultants were engaged to provide relevant expertise and services. Together, they adapted existing or developed new management tools to monitor and control time, cost, quality, and more importantly, fostered a professional working culture and a unique spirit of partnership.

With as many as 30,000 workers from more than 50 countries working at the peak of construction, cross-cultural communication was important. In the span of six years, KLIAB had moulded a unique working culture and environment that united these people into a well-disciplined and cohesive group working towards a common goal. According to Hussien and Karimin (2006), the biggest value proposition for project management, particularly in managing large-scale complex time bound projects relates to the way project organisation and the team members execute the following set of project implementation methodology:

1. *Communicating and managing expectations with clients, team members, and stakeholders more effectively.* Many problems on a project can be avoided with proactive and multi-faceted communication. In addition, much of the conflict that arises on a project is not the result of a specific problem, but because of surprises. Standard methodologies always focus on formal and informal communication, which results in fewer surprises.

2. *More focus on metrics and fact-based decision-making.* One of the more sophisticated aspects of project management methodologies is that they provide guidance to make it easier to collect metrics (measures). Metrics give you information that helps you to determine how effective and efficient your team is performing and the level of the quality of your deliverables.
3. *Improved work environment.* If the project is well planned and per forms accordingly the work environment improves tremendously. Clients will be more willing to provide additional support, project team members will take more ownership of the project, morale will be better, and the project team will behave with a greater sense of professionalism and self-confidence.
4. *Resolving problems more quickly.* On many occasions, some team members spend too much time and energy dealing with problems because they do not know how to resolve the problems to begin with. Having a proactive issue management process helps ensure that problems are resolved as quickly as possible.
5. *Better solution "fit" the first time through better planning.* Many projects experience problems because there is a gap between what the client expects and what the project team delivers. Using project management methodology results in better project planning, which gives the team and the sponsor an opportunity to make sure they are in agreement on the major deliverables produced by the project.
6. *Resolving future risk before problems occur.* All project management methodologies have processes in place to identify and manage risks. Risk management will result in potential problems being identified and managed before the problems actually occur.

Strategic Project Planning

It is the task of the project planner/s together with the project team members to pierce through the maze and come out with the necessary strategies, plans, and system of control. The planners need to analyze the whole macro and micro project delivery processes in detail (see Figure 5 and Figure 6) to seek potential conflicts that constrain the delivery process. Interest of the project's stakeholders need to be cross-checked and streamlined with the competing demands coming from the external and internal

project environment to determine and establish 'what' needs to be done in what manner and 'how' will it be done in order to meet the predetermined project objectives in time, quality, and cost. Appropriate project strategy vis-à-vis the project's critical success factors needs to be established for an appropriate project structure and management control system to be developed.

Figure 5: Framework to control project complexity

The essence of managing complexities is about control and the ability of the implementing organisation to increase effectiveness in its managerial span-of-control. When the risks are high, the key to risk management and control of the project performance is effective planning. This is to ensure plans that are put in place effectively streamline and offer quick responses to any conflicts and issues arising out of the competing demands from external and internal parties.

The performance of managerial control over the project to meet project objectives and goals will be largely dependent on strategies formulated to control not just planned work activities duration, cost, and quality but also, manage complexities, the aspects on project organisation and information control (see Figure 6).

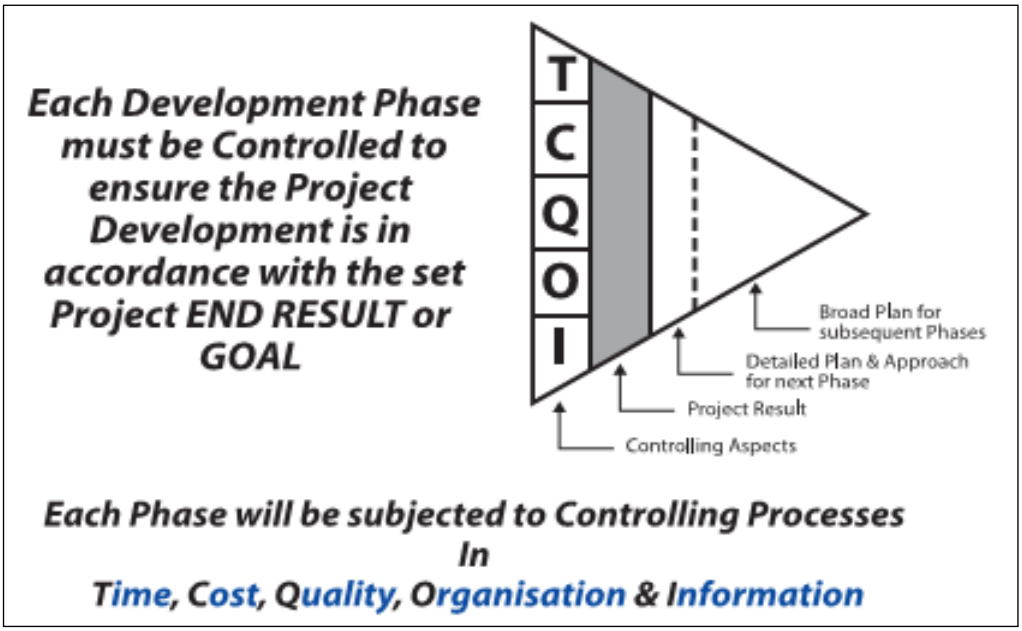

Figure 6: Elements in Project Control

Due to the different nature of work activities as the project undergoes different project phases, set of requirements for the five control elements also changes. The control processes of these five control elements need to be planned and structured to correspond to the requirements and complexity of work content and activities in each and sometimes overlapping phases.

The planning process starts not just with the project scoping and the project technicalities but more importantly looks at the strategic element of the project. Failure to look at this aspect, particularly in managing complex job, will render inadequacy and ineffectiveness to the project organisation to respond and make timely decision on issues, complications, and conflicts that arises throughout project phases.

Once the planning exercise is completed, project implementation plans which also includes the monitoring and control systems, must be effectively transmitted and communicated to the various organisations in the project team. These plans should adequately address the critical implementation considerations, as follows:

- Project implementation strategies in architectural and engineering design concept and work approach; the most effective procurement and contractual approach; funding and cost management, quality assurance and quality control implementation; most suitable project organisation structure; effective

monitoring and control system; vis-à-vis the established project critical success factors.

- Master work implementation programme, schedules and work activities methodologies.
- Authority level and decision-making structure and protocols.
- Communication and information flow structure and protocols for the whole project organisation – includes document management.
- Organisational, managerial and administrative procedures.
- Risk management plan

Conclusion

It is important to be aware that by putting up a project management system and methodology will not necessarily lead to project performance if the project management culture within the project organisation and team member level of project management knowledge and practice is low and inadequate. Project success also has to do with the level of competency of individual team members in the 'know-what' (project management body of knowledge, disciplinary knowledge) and the 'have what' (experience-know how, humanistic/soft skills).

The level of competency is very much dependent on the level of exposure and capability of the project manager and members in his project organisation (these are the know who) in utilizing the 'know-what' and 'have what' specific to the project external and internal environment requirements to match the project success metrics. In addition, both of these aspects of competency must at the same time be matched with the required level of competency in the various technical disciplinary fields to enable the right planning, problem-solving and decision-making.

In the final analysis, the sum of the level of competencies of the individual team members and project management organisation in the 'know what' and the 'have what', and 'know how' of the technical disciplinary knowledge will ensure project issues are being address in a proactive, systematic and timely manner. When an organisation develops this project management working culture, one that is characterized with team-working, process and goal -orientated, discipline, problem-

solving, and decision-making traits, the odds for a project to perform and achieve success will be very much increased.

From the experiences of the KLIA project, several important aspects that need to be given serious effort to ensure that large-scale projects achieve the desired performance and success are the need for effective project management on both Client/Owner and Contractors organisation – knowledge, experience and competency; managing large-scale projects is about managing complexities – work content and work processes; strategic project planning is key to control and good leadership is vital for success.

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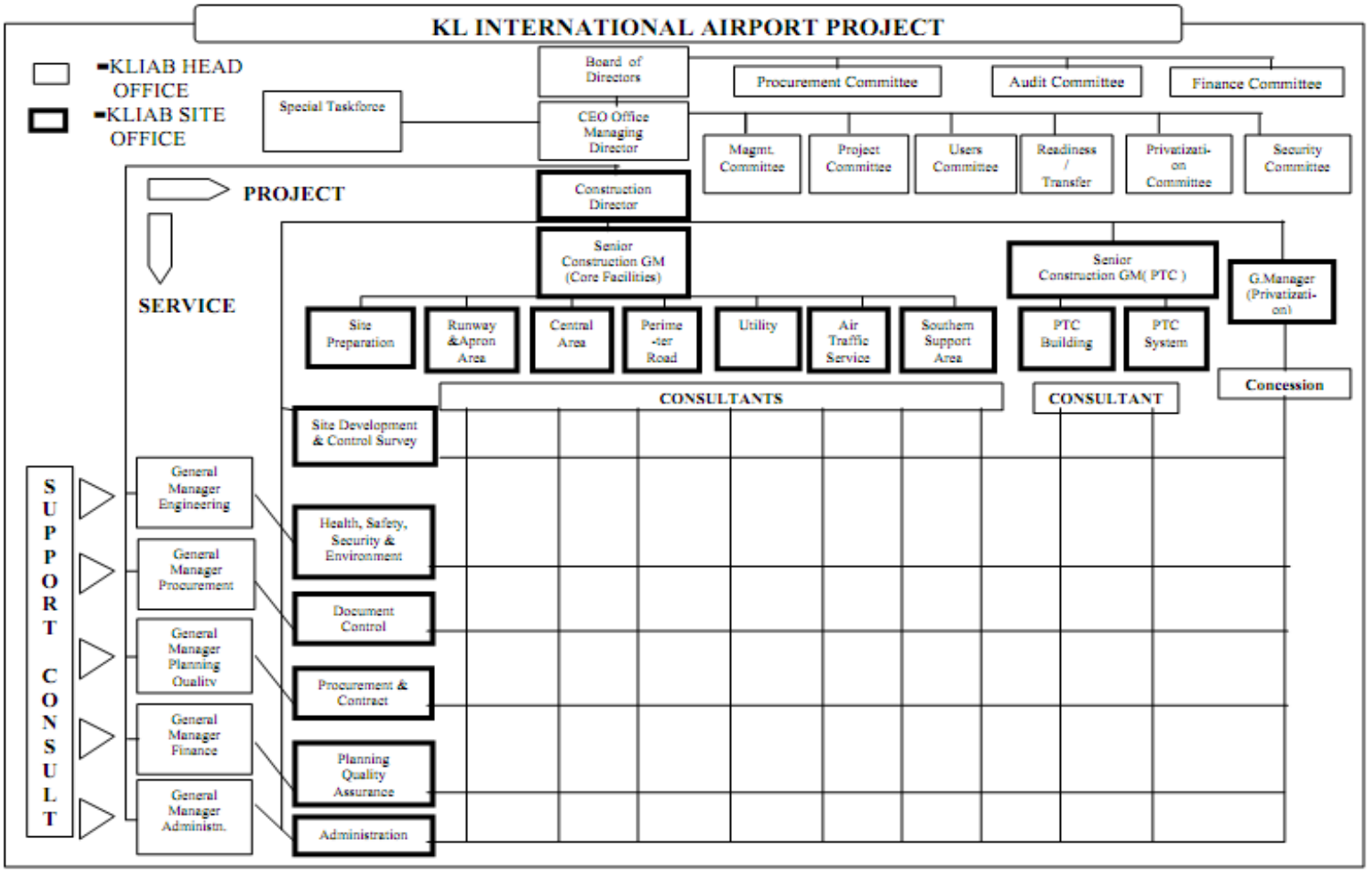
Appendix


KL INTERNATIONAL AIRPORT PROJECT
KLIAB HEAD OFFICE
KLIAB SITE OFFICE
PROJECT
SERVICE
Special Taskforce
Board of Directors
Procurement Committee
Audit Committee
Finance Committee
CEO Office Managing Director
Magmt. Committee
Project Committee
Users Committee
Readiness / Transfer
Privatizati-on Committee
Security Committee
Construction Director
Senior Construction GM (Core Facilities)
Senior Construction GM(PTC)
G.Manager (Privatizati-on)
Site Preparation
Runway &Apron Area
Central Area
Perime-ter Road
Utility
Air Traffic Service
Southern Support Area
PTC Building
PTC System
Concession
CONSULTANTS
CONSULTANT
Site Development & Control Survey
SUPPORT CONSULT
General Manager Engineering
General Manager Procurement
General Manager Planning Quality
General Manager Finance
General Manager Administn.
Health, Safety, Security & Environment
Document Control
Procurement & Contract
Planning Quality Assurance
Administration

TEACHING NOTES
DECISION MAKING APPROACHES IN PROJECT MANAGEMENT: A STUDY IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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Mohd Imran Khusairi Shafee
Rahimi Abidin

Synopsis

This case presents the perspective of a Malaysian construction company, KLIA Premier Holding Berhad which was in the process of completing a mega project with very limited time. The project came into being in the late 1990s, to relieve the strain on the existing Sultan Abdul Aziz Shah Airport. KLIA is currently designed to handle around 25 million passengers and one million tonnes of cargo a year. It is to be developed in three phases, building up to a final capacity of 100 million passengers per annum. Only the first phase is under consideration here. The company had to confront with time constraint to complete and operate the mega scale project within 6 years from point of decision to build-normal 10-12 years. At the beginning of the project was the company. To achieve these objectives, it was important for the company to have innovative strategies in managing the project.

Target Group

Undergraduate students

Learning Objectives

This case was written to provide a detail story of a successful construction project. It could be used in a strategic management course. It gives student a chance to explore and understand on how decisions are made in project management in construction industry.

This integrated case study aims

1. To examine the strategy used in construction project
2. To identify the possible critical problem and dilemma of a company and how decision making are made in project management
3. To identify conflict that may be faced by a project manager in handling a construction project
4. To suggest and recommend the probable solutions or alternative actions
5. To address the issues that may deter the construction project performance

Case Leading Strategy

1. The students should be familiar in the Malaysian construction industry.
2. The class will be divided into groups of four to discuss the case
3. The class discussion should be over two lecture sessions of at least 90 minutes duration
4. The first lecture
    a. 10 minutes- The case brief by the facilitator
    b. 15 minutes- Individual reading (this can be done without if the case is given ahead of the class)
    c. 20 minutes- Group discussion
    d. 30 minutes- Class discussion raising issues and strategies for knowledge search
    e. 15 minutes- Summary and critique by facilitator
5. The four groups will be given a 'project'. The project will have various obstacles or problems that each of the groups needs to find a solution to. The 'project' can be the same 'project' with different ways of solving the problem OR each group has different 'project' with different problems.
6. Research- 1 week for research external to the classroom and preparation for presentation.
7. The second lecture

    Role play – Each group will take turn in presenting their solution to the 'problematic project' and the reasoning for the solution while the other 3 groups act as the Board of Directors and evaluate the given solution based on a set of criteria:

    a) Feasibility
    b) Economical

c) Time consumption
d) Green concept
e) Etc.

Suggested Questions

1. Identify the issues faced by Malaysian construction industry.
2. Identify new strategy implemented by Malaysian construction industry.
3. How important leadership is in managing construction project? Could you recommend how construction industry in Malaysia can be better?
4. A mega construction project such as the Kuala Lumpur International Airport project involved massive number of employees. How did the KLIAB manage to minimise behavioural problems amongst the employees with reference to Maslow's Hierarchy of Needs? Give example of decisions made by KLIAB that suit with these theories.

Suggested Answers

1. Based on the case study, the issues faced by KLIAB
   i. The deadline - The urgency to have the airport built by 1998 required innovative strategies to manage the project.
   ii. The implementation of ISO 9000 - It was a great challenge for the KLIA Construction Management Team to implement the ISO quality system in a large project, which involved nearly 150 major contracts with more than 110 major contractors and 1600 interfaces between participants. The QMS plan implemented in the KLIA project was referred to as Project Quality Plan (PQP). The critical quality elements were: 1) management responsibility; 2) quality planning; 3) resources management; 4) process control; 5) inspection and testing; 6) quality recording; 7) auditing; and 8) data analysis and report.
   iii. Relocating communities - Relocating communities is not easy. KLIAB sought the assistance of the Aborigines' Affairs Department (Jabatan Hal Ehwal Orang Asli) to make their relocation as painless as possible. To ensure that the orang asli would enjoy a better life in their new village, the Federal Government had to work through the traditional *orang asli* hierarchy and took several measures. They were

compensated for their loss of land, with some families receiving up to RM100, 000. To help them spend their compensation wisely, the Aborigines; Affair Department conducted meetings (through their headman) on how to invest their money.

iv. Third is the transient worker - Remote construction sites are notorious for hastily built slum settlements of *kongsis* mushrooming overnight. The crammed living quarters often supports more bodies per square meter than Wembley Stadium at the FA Cup final. Coupled with the fact they often do not have piped water, electricity and suffer from badly maintained communal facilities, they health hazards waiting to explode. Cross-culture interactions resulted in contradicting work culture, and language barrier posed many unavoidable problems.

v. The earthwork - Earthworks are literally the groundwork for construction relay race; it frequently sets the pace of work to come. At KLIA construction of the earthworks platform assumed epic proportions because of the sheer size of site and the speed with which the job had to be completed. The airport site was unprepossessing territory, dense estates of thorny oil palm, rubber trees and swamp vegetation that merge into a seamless curtain of resistance.

2. Example of new strategy implemented by KLIAB

- Used a sound procurement strategy that prioritised fast-track methods. The foundation for fast-tracking was laid by the Engineering Design Contract, and out of this grew the KLIA Master Implementation Programme, the cornerstone of the procurement strategy, for the full development of KLIA. The time-driven Master Implementation Programme organised all construction activities into a systematic framework of realistic timelines.
- KLIA's procurement strategy revolved around a selective combination of fast track design-and-build and conventional fast-track methods.
- The work contracts were broken into packages according to their respective areas. Three types of contracts were awarded:
    - Fast track conventional tenders
    - Fast track design and build tenders

- Conventional tenders

- For the fast-track design and build and conventional contracts, tenders were invited based on preliminary engineering and architectural designs, with enough information for contractors to tender. Successful contractors were then issued just-in-time working drawing during the construction stage. Competitive tendering and just-in-time fast tracking approach eventually saved KLIAB a great deal of time in getting contractors to begin work on site.

3. Project leadership is a very important skill and is very crucial to the success of a project. Project leadership is about deciding on the right project, knowing the project priorities and knowing how to create value.

   From the experiences of the KLIA project, several important aspects that need to be given serious effort to ensure that large-scale projects achieve the desired performance and success are:-

   - the need for effective project management on both Client/Owner and Contractors organization knowledge, experience and competency;
   - managing large-scale projects is about managing complexities work content and work processes
   - strategic project planning is key to control and good leadership is vital for success.

   The leader should have a good sense on how the environment changes and is responsible in adapting his construction firm to the changing environment. The leader is more concerned with the overall strategy of the project and is focused on the external environment in which the project operates. Hence, the project manager, as a leader must be able to exert interpersonal influence in order to lead the project team. The members of functional departments may be accustomed to a single reporting line in a hierarchical structure in a matrix organization, but the project manager coordinates the activities of the team members drawn from functional departments. In general, the project manager's authority must be clearly well defined, particularly in matrix organization where the functional division managers often retain certain authority over the personnel temporarily assigned to a project. The project manager should

encourage problem solving rather than role playing of team members drawn from various functional divisions.

1. Maslow's Hierarchy of Needs: The needs are the basics that all human must have in order to live and survive. These basic needs are also called "deficiency needs" because if they are not met by an individual, then that person will strive to make up the deficiency. These needs are normally listed in a hierarchical order in the form of a pyramid to show that the basic needs (bottom ones) must be met before the higher order needs:

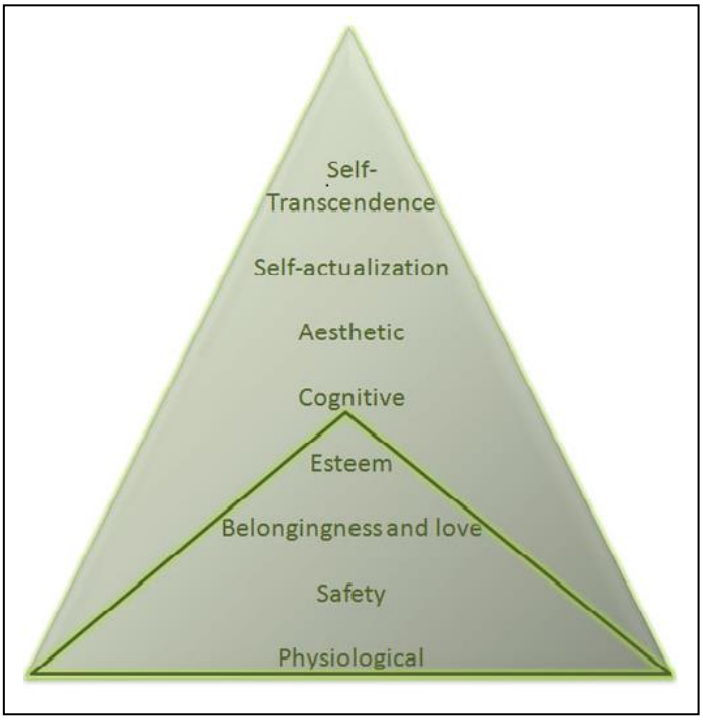

Figure 1: Maslow Hierarchy of Needs

8. Self-transcendence - a transegoic (see Note below) level that emphasizes visionary intuition, altruism, and unity consciousness.

7. Self-actualization - knows exactly who you are, where you are going, and what you want to accomplish. A state of well-being.

6. Aesthetic - to do things not simply for the outcome but because it's the reason you are here on earth - at peace, more curious about the inner workings of all things.

5. Cognitive - to be free of the good opinion of others, learning for learning alone, contribute knowledge.

4. Esteem - feeling of moving up in world, recognition, few doubts about self.
3. Belongingness and love - belong to a group, close friends to confide with.
2. Safety - feels free from immediate danger.
1. Physiological - food, water, shelter, sex.

Examples from the case study

1. During the early construction stage of the KLIA, the migrant workers live in a hastily built slum settlements of kongsis mushrooming overnight. The crammed living quarters often supports more bodies per square meter than Wembley Stadium at the FA Cup final. Coupled with the fact they often do not have piped water, electricity and suffer from badly maintained communal facilities, they health hazards waiting to explode. Cross-culture interactions resulted in contradicting work culture, and language barrier posed many unavoidable problems. This did not comply with the most basic physiological needs of the workers according to Maslow's Hierarchy of Needs.

   To overcome this problem, KLIAB decided to build a township on a 40-acre site at the edge of the airport where migrant workers could live and work close to the 33 work sites scattered across 25,000 acres. A well-planned town catering to the needs of the KLIA workforce, particularly, manual staff, was considered important in helping alleviate many of the social and health problems associated with kongsis and shanty towns the world over. The town was built in 1995. It provided housing, transport, food, community and commercial facilities to a peak-time population of 30, 000 workers from more than 50 countries. With basic needs being fulfilled, the construction projects were able to run smoothly without any major problems.

2. The site identified for KLIA comprised a few sleepy settlements lost amidst rolling hills of rubber and palm oil plantations. A small community of 85 orang asli (aborigines) families was living there. They were mainly smallholders cultivating rubber, durians and other tropical fruits on their 891-acre settlement. They had to be moved. However relocating

communities is not easy. KLIAB sought the assistance of the Aborigines' Affairs Department (Jabatan Hal Ehwal Orang Asli) to make their relocation as painless as possible.

To ensure that the orang asli would enjoy a better life in their new village, the Federal Government had to work through the traditional *orang asli* hierarchy and took several measures. They were compensated for their loss of land, with some families receiving up to RM100, 000. To help them spend their compensation wisely, the Aborigines; Affair Department conducted meetings (through their headman) on how to invest their money.