

## EFFECTIVE PROCESS PLANING ON LIPOPO CONSTRUCTION PROJECT AS CASE STUDY

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### **Abstract**

In this ever changing world, nothing is permanent. New discoveries and technologies are making its way out every day and in every possible form. These changes make life easier and complicated at the same time. Therefore, it is important to have an open mind and to experiment around.

It would not be wrong to say that The Construction Industry is affected and also benefitted with these ongoing changes around. If we hear about credit crunch some day, we also hear about upswing in market another fine day; it's become that unpredictable. Hence, it is the need for having proper planning and precise thinking for future.

The word PROCESS is defined in dictionary as “a systematic series of actions directed to some end” with operations and changes taking place in a definite manner. Planning the process of working in the project is an important issue. In recent years so many processes have been introduced around. All processes are developed with the essence to captures best in the construction industry, i.e. to achieve cost, quality and time objectives and also sustainability nowadays. Selection of right process has become vital in construction industry as it highly determines the end result of the project, whether it would be declared a success or a failure.

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## 1.0 Introduction

This report is an assessment of process options and its' important features relating. It deals with analyzing two process methods: RIBA Plan of Work and The Generic Design & Construction Process Protocol (GDCPP) to the context of LIPOPO's Strategic Computing Complex (SCC), UK. This report focuses briefly on project background and goals. It also features procurement option chosen for the project, i.e. Design & Build and the framework for the involved team members. In the RIBA plan of work deals with the mapping done from the constructor point of view, i.e. RIBA Plan of Work which is well known in the field of construction and is standardized form of working. There is critical appraisal of the current method of working listing down its merits and demerits. Also this report includes The Process Protocol (GDCPP) mapping which was developed in 1995 using manufacturing principles as a reference point. It lists down important features of this mapping process in context with LIPOPO's SCC project and the evaluation of merits and demerits for the given project.

## 1.1 Project Description and Goals:

### LIPOPO- Strategic Computing Complex (SCC)

LIPOPO's Strategic Computer Complex is built for housing world class super computers and a nuclear design weapons design staff. It is owned by Department of Energy of LIPOPO National

Laboratory, UK. Considerations to be made on facilities like safety, security, efficiency, life-cycle costs, working conditions and the need for flexibility to address changing computing technology. There are various project goals such as accessibility, aesthetic, functional, etc. Security and safety is one of the key concerns of the project as for the need to operate super computers under an extremely secure environment. Similarly, energy is another major issue as there would be large demand for it by the computers, hence need for energy efficiency and sustainability goal.

## 1.2 Procurement Route:

Procurement Route chosen for the project is Design & Build. Masterman (2001) describes this procurement method as a package deal, calling it an integrated system where one organization, generally a contractor, takes all the responsibility of managing the design and construction of the project. Therefore, we (the constructor) would be involved from the early stages of the project, taking all the accountability of LIPOPO's SCC project.

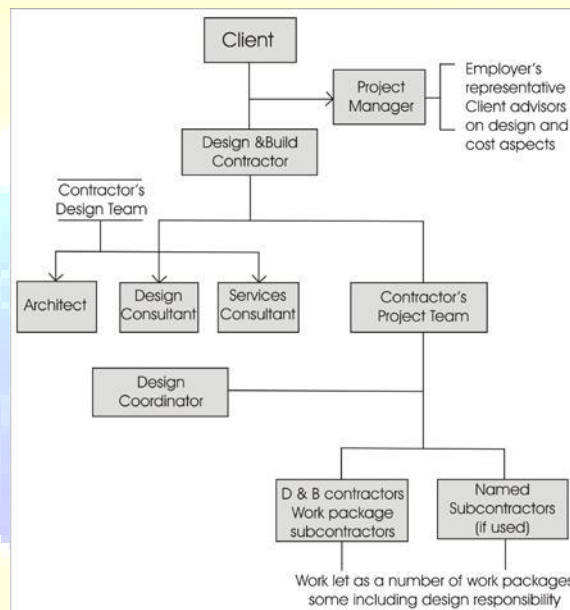


Figure 1: Design & Build team- Cooke and Williams (2009, p.34)

## 2.0 RIBA PLAN OF WORK:

### 2.1 Introduction to RIBA Plan

The Construction Process in today's time is not only limited to procurement choices or certain activities but the whole project processes in terms of activities and stages needed to complete a project. Importance of these activities identification is that it clearly defines the stages and evolution of the project as well as its intensity, hence the need for improvement during the

project and also for future references. Bennett (2003, p.7) states that “Every project, not just those in construction industry, goes through a series of identifiable phases, wherein it is 'born', it matures, it carries through to old age and it 'expires’”. Further elaborating on that the process of project in construction phases goes through with client making certain pre-project decisions, then the design is being carried out which is followed by construction on site. Lastly, the project must be terminated and brought to a close. There are some existing design and construction process models in operation like RIBA Plan of Work, Construction Industry Board (CIB) Code of Practice, British Property Federation (BPF) to name a few. All these process models give processes for the practice in the construction projects.

**2.2 RIBA plan of work in LIPOPO:** The Royal Institute of British Architects Plan of Work was originally published in 1964 and the way it works for SCC, LIPOPO project is detailed out as it is widely accepted as in operational model throughout building industry.

Keeping RIBA Plan of work in mind, LIPOPO’s SCC project would be also categorized into following phases:

- a. Feasibility
- b. Design
- c. Pre Construction
- d. Construction
- e. Post Construction

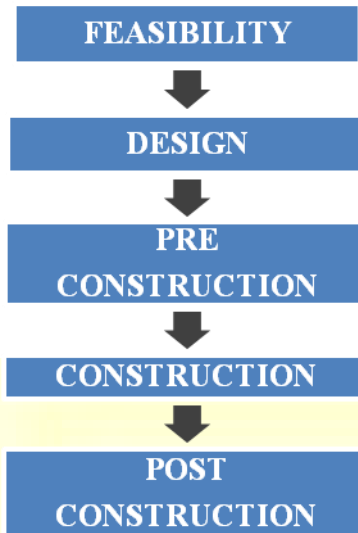


Figure 2: Key Phases for LIPOPO's SCC

And within these key phases, there would be stages also known as sub processes important for the project. Any project needs a vision and key performance indicators to be identified up front.

They should be assessed at each stage to monitor achievement and check that they are still appropriate. For a project like LIPOPO's SCC; that wants to integrate sustainability in all aspects of a project this is even more important, as it will involve some changes to conventional methods and new ways of working need strong management support if they are to be successfully implemented.

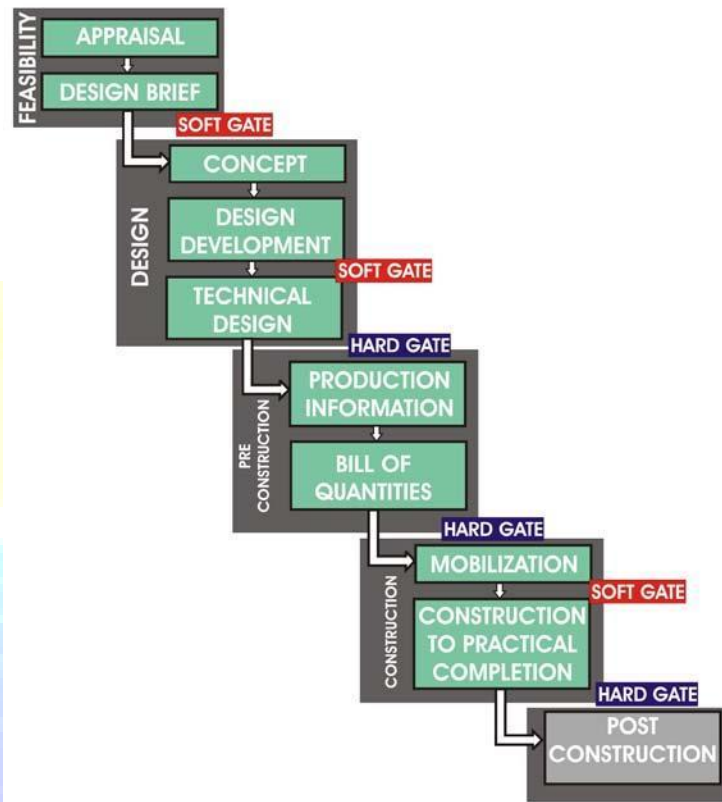


Figure 3: RIBA Plan of Work adopted for LIPOPO's SCC

The detailed description for the phases and stages are as described for LIPOPO:

a. Feasibility: The first phase of LIPOPO would be realization of need for the project and client's main objective in this project. This phase would consist of two stages-

i. Appraisal: Identification of LIPOPO's needs and objectives and then the preparation of feasibility studies and assessing it. From that to derive what resources will LIPOPO can make available and what needs to be sorted out.

ii. Design Brief: Important role of the client, i.e. LIPOPO as it would be looking at key requirements and constraints. Then getting the vision of project on the paper and developing of design brief. Since the procurement option is decided i.e. Design and Build decisions on resources, responsibilities and risks to be discussed.

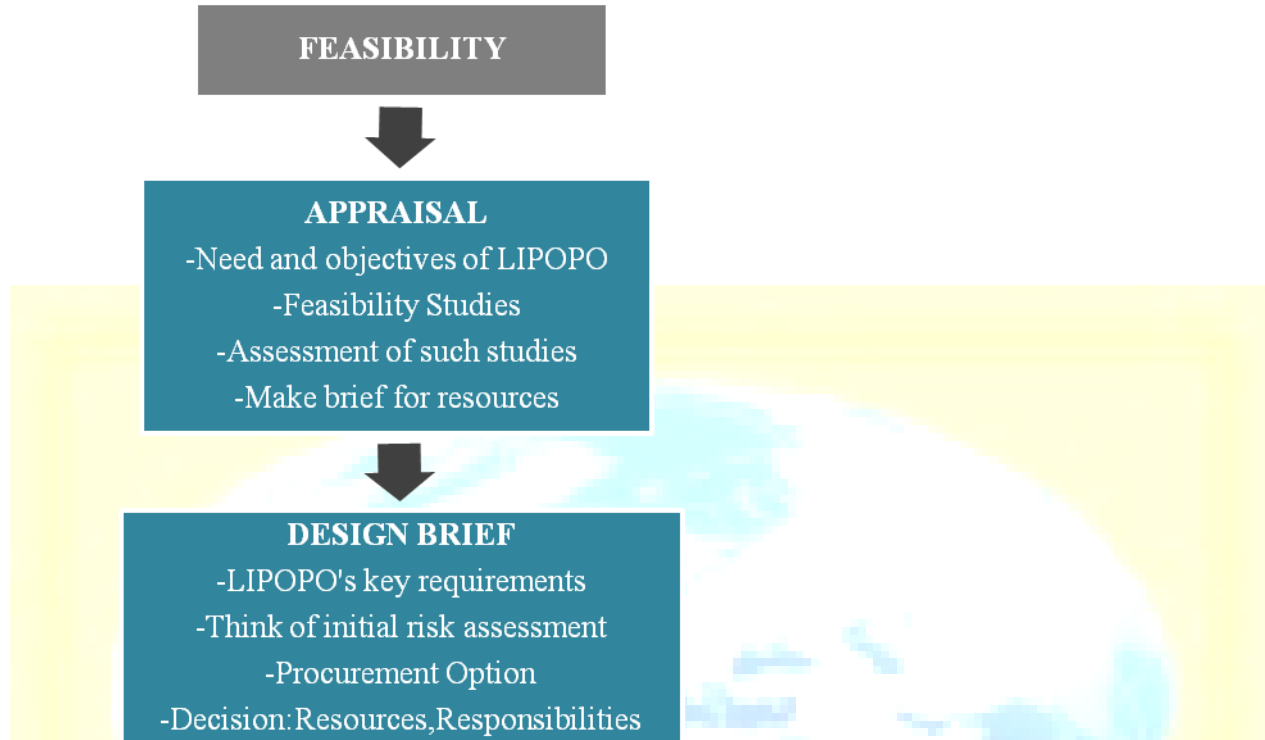


Figure 4: RIBA Plan of Work: Feasibility

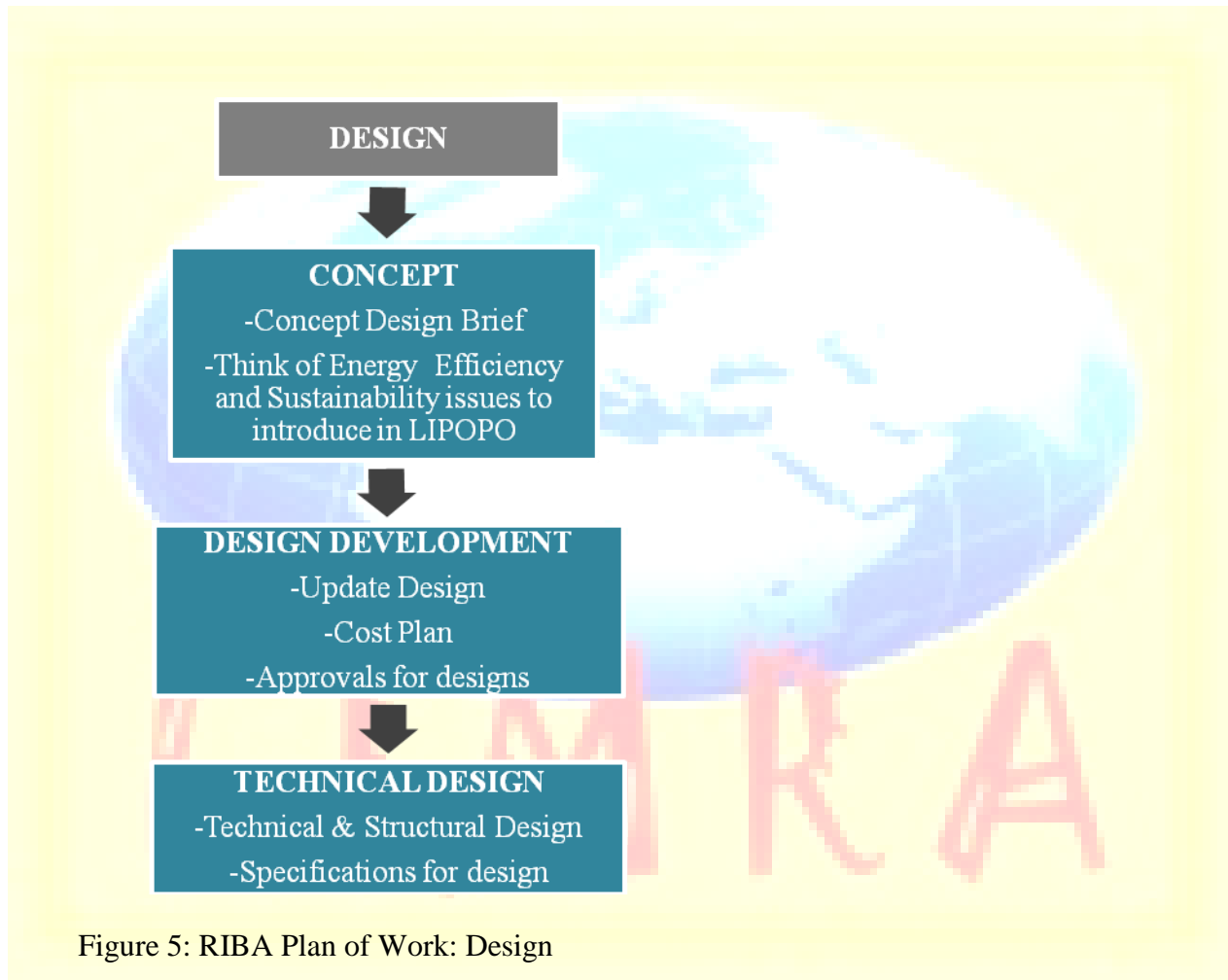
b. Design: This phase works with design consultant team and is divided into three stages-

i. Concept: Implementation of design brief and putting up of additional data.

Preparing the concept design with thoughts on building service systems and specifications. LIPOPO also talks about energy efficiency and sustainability, hence studying the material on these issues and trying to implement it from concept level of design.

ii. Design Development: Developing concept design into full fledged design with all services and facilities and cost plan. All approvals will be obtained at this stage, including for Building Regulations.

iii. Technical Design: Preparing technical and structural design and specification according to standards and regulations. Since the procurement method adopted is Design and Build, it becomes bit easier for small changes happening after this stage but still such further changes would be minimum for smooth flow of the work.



c. Pre Construction: Just before starting construction, this phase comes under which the stages are-

i. Production Information: Preparation for detailed information for construction related to all fields of LIPOPO on matter of design, specification, construction and cost. All statutory approvals should be obtained by the end of this phase.



ii. Bill of Quantities: Itemizing and scheduling all the elements of the design required to complete the works. This is not only including the items indicated on drawings but also other conditions required to carry out the works for project like site establishment.

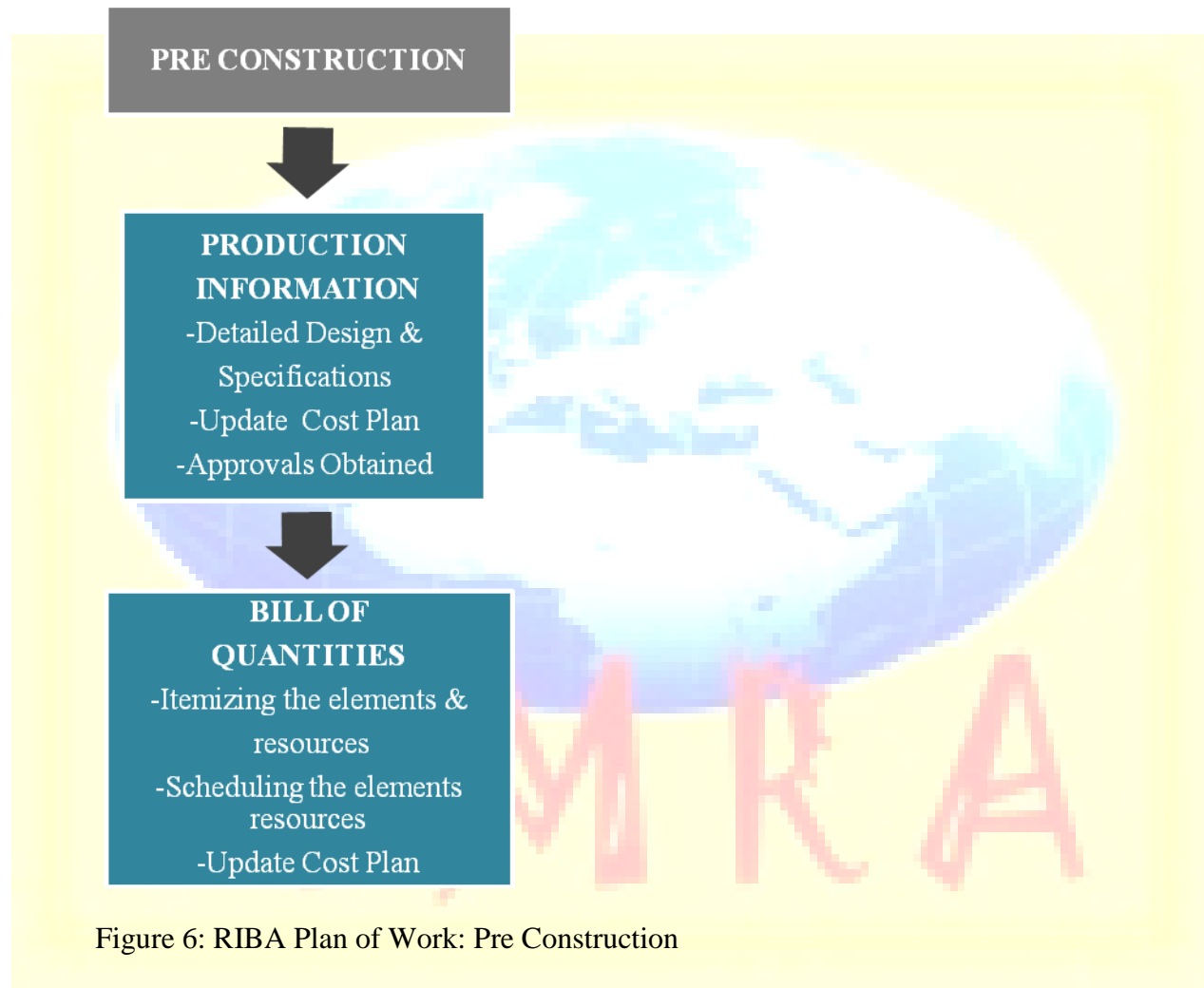


Figure 6: RIBA Plan of Work: Pre Construction

d. Construction: The actual building of SCC project on the site will happen in this phase which is divided into two stages-

- i. Mobilization: Production information issued and site is handed over to the contractor.
  
- ii. Construction to Practical Completion: Programming the work in accordance with the contract and commencement of work on the site. Administration of the building contract to Practical Completion. Further information supplied to the contractor as and when reasonably required.

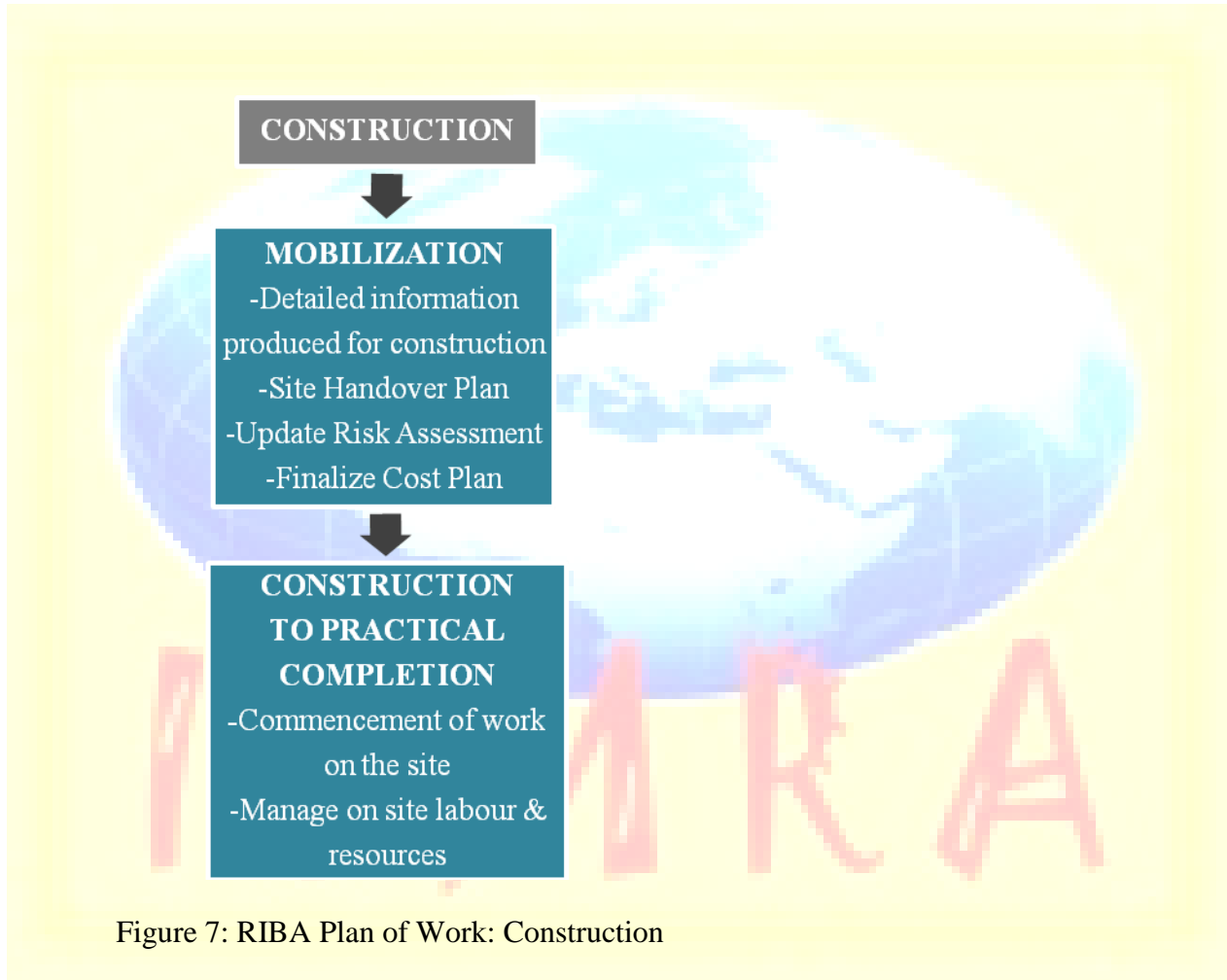


Figure 7: RIBA Plan of Work: Construction

- e. Post Construction: Final inspections are made to ensure specifications have been met. In addition, the final account is settled. After that the building would be handed over to LIPOPO. This phase can also be called as Feedback as review of project performance would be done.

**POST  
CONSTRUCTION**

- Inspection and checking
- Final Account Settled
- Feedback on project performance

Figure 8: RIBA Plan of Work: Post Construction

### 2.3 Merits and Demerits of RIBA:

First and foremost, RIBA plan of work is very standardized and is divided into easy to understand stages. With slight adjustment considering the nature of the project and its complexity, timely decision can be made. RIBA is known well in the field of construction– it is tried and tested model over the years developed on feedback from practitioners.

The Strategic Computer Complex, LIPOPO is a big project considering its stature; therefore the step-by-step process identification is of utmost importance as it will clearly indicate procedures to be followed in such secure project wherein one simple mistake can lead into lots of risks.

RIBA is said to be linear in its construction requiring one stage to be completed before the next and hence more suited for traditional procurement approaches. Moreover, it was developed from the viewpoint of an architect. Therefore, Mugrove *et al.* (2003; p.6) say that “in practice this model may be biased towards the status and role of the architect as it was prepared by the RIBA. Although it mentioned the role of other participants, its description is very shallow and brief”.

To add more, the activities are 'identified' only. It does not mention their sequence and who are the responsible parties. LIPOPO is a sensitive project to handle considering the safety and security issue it has, hence getting to know each and every responsible party for the project is extremely crucial.

### 3.0 The Process Protocol

#### 3.1 Introduction:

The Generic Design & Construction Process Protocol (GDCPP) was developed by University of Salford. The official website of Process Protocol states that "it uses manufacturing principles as a reference point, a framework of common definitions, documents and procedures which were developed to help construction project participants work together seamlessly".

It further explains that the aims and objectives of Process Protocol is to influence "process" thinking throughout the entire construction industry and development of wide sub processes illustrating the framework for process improvement.

The Process Protocol has divided the design and construction process into different phases which are grouped under 4 stages:

- a. Pre- Project
- b. Pre- Construction
- c. Construction, and
- d. Post- Construction/ Completion

Pre- Project Stage: Curwell *et al.* (2005, p.125) emphasizes the importance of this stage by referring to DTI (2003) report which mentioned that the pre-project phases are the most important, because many of the decisions taken in this largely determine or lock-in many options in later phases. It relates to considerations of any potential project, keeping client's need in mind.

This stage consists of:

- i. Phase Zero- Demonstrating the Need
- ii. Phase One- Conception of Need
- iii. Phase Two- Outline Feasibility
- iv. Phase Three- Substantive Feasibility Study & Outline Financial Authority

Pre- Construction Stage: Development of client's need into design solution. This stage is divided into following phases:

- i. Phase Four- Outline Conceptual Design
- ii. Phase Five- Full Conceptual Design
- iii. Phase Six- Coordinated Design, Procurement & Full Financial Authority

Construction Stage: This stage is based on production of the project solution and is categorized into:

- i. Phase Seven- Production Information
- ii. Phase Eight- Construction

Post- Completion Stage: This stage focuses on monitoring and managing the maintenance needs of the constructed facility, i.e.:

- i. Phase Nine- Operation and Maintenance

### 3.2 Generic Process Protocol in LIPOPO:

#### 3.2.1 Importance of Project Phases:

The Process Protocol will divide LIPOPO project into 4 stages which will be further divided into nine phases, with each phase playing a crucial role towards the achievement of project successfully. (Main Map- Refer to Appendix 5.2; Detailed Map of Each Phase- Appendix 5.3)

- a. Pre-Project Stage: We, as contractor would be involved in project from early stage of the project and therefore would be monitoring the project from the word 'go'. The whole of

Pre- Project Stage would be extremely important since it will form the base of the project and areas of work would be identified by LIPOPO itself. Also LIPOPO would provide its active participation in this stage of the project.

Phase Zero- Demonstrating the Need: Need of the project and identification of its key objectives.

Also LIPOPO would outline the business needs out of the project. To execute the project well, execution plan would be developed with identification of probable stakeholders in the project.

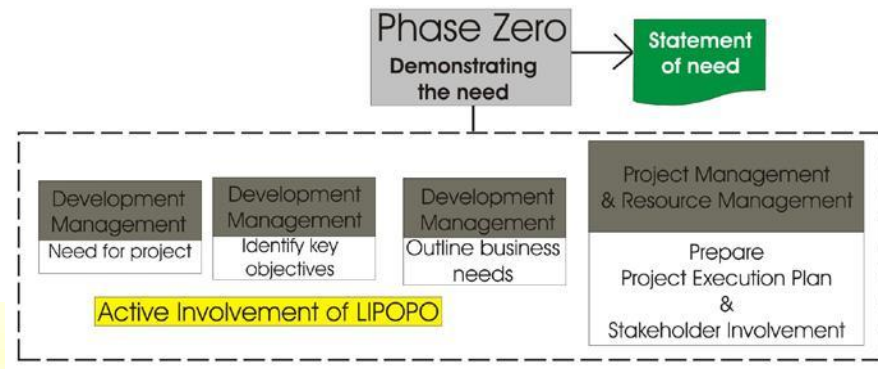


Figure 9: The Process Protocol- Phase Zero

Phase One- Conception of Need: Preparation on initial concept brief with the help of our (contractor's) in-house design team. Checking and planning of what all needs to be done for feasibility for example conditions of the site, access etc. Opening of risk register also happens in this phase and would be updated further in every phase of the project.

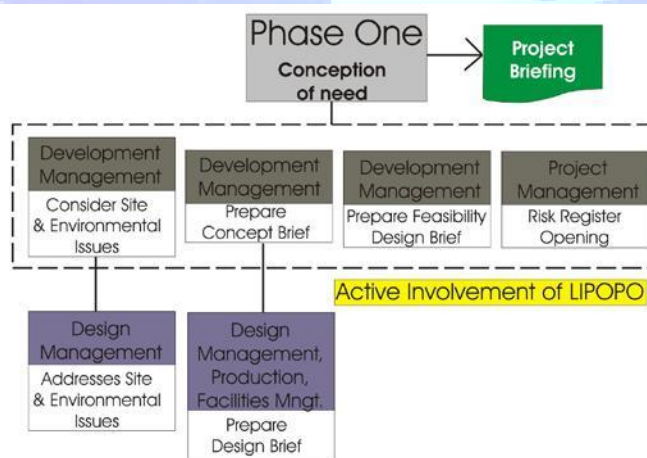


Figure 10: The Process Protocol- Phase One

Phase Two- Outline Feasibility: Update of business case and undertaking of feasibility study for each option.

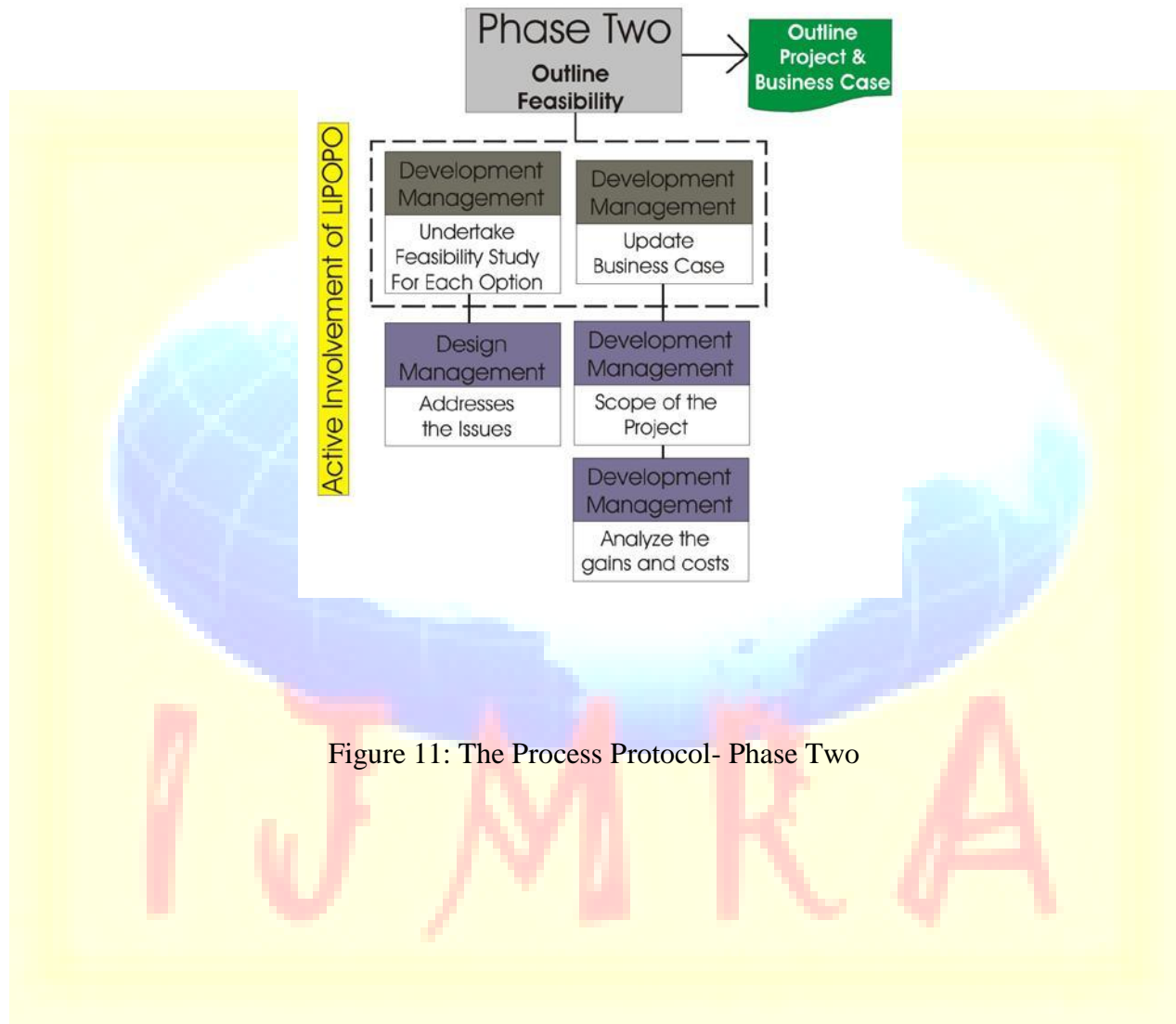


Figure 11: The Process Protocol- Phase Two



Phase Three- Substantive Feasibility Study & Outline Financial Authority: LIPOPO takes a bit of back seat from now on and controls the project on each phase review period. Since next step would be designing of the project, all the parties come together and discusses on procurement option for the project along with updating of project brief and business plan.

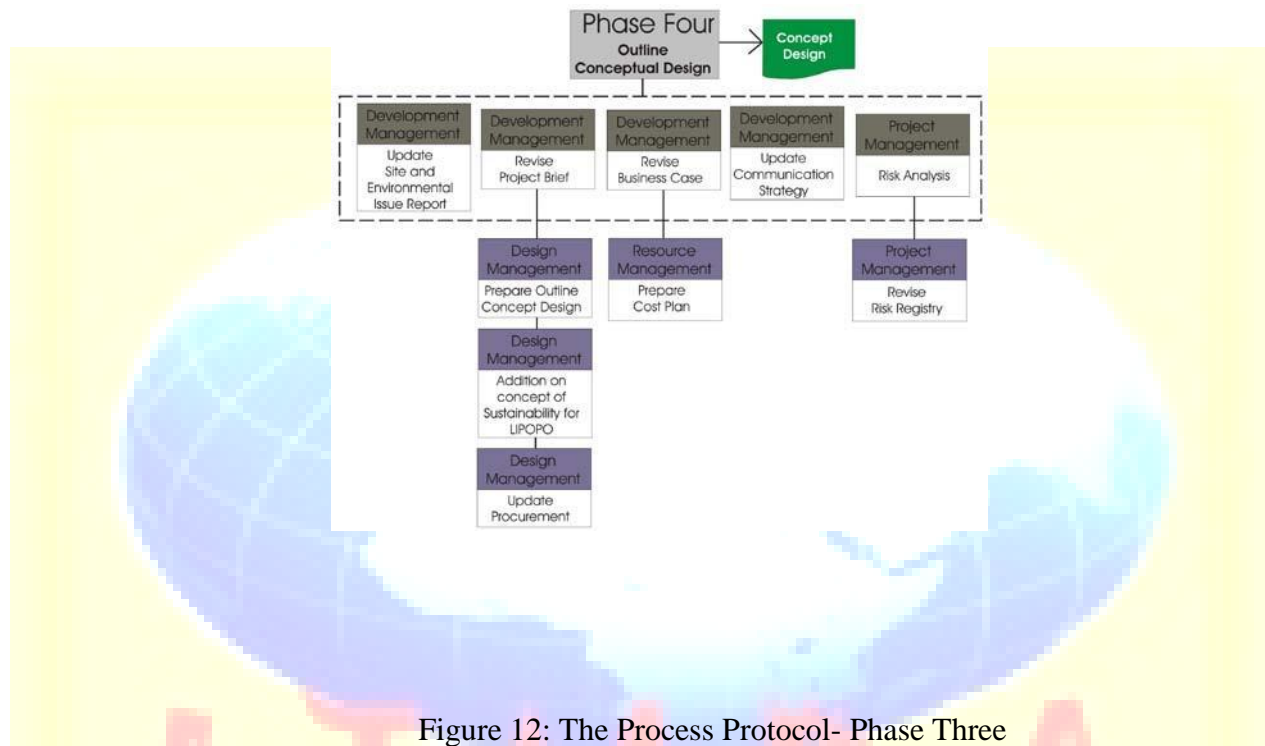


Figure 12: The Process Protocol- Phase Three

- b. Pre- Construction Stage: After getting LIPOPO’s brief on how the project should look and what the main objectives are, the design process would be carried out.

Phase Four- Outline Conceptual Design: Besides regular update on brief and business along with site issues report, the outline design would start by design consultants. Sustainability is one of the key issues for the project, hence special focus would be given on that issue and studies would be done on it for implementing it in the design. Also, the thought on cost plan would be discussed from now on.

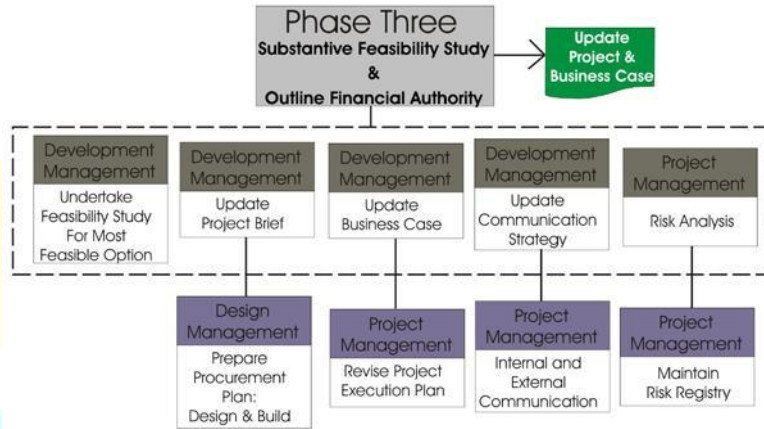


Figure 13: The Process Protocol- Phase Four

Phase Five- Full Conceptual Design: Preparation of full concept design and renewing of brief and business case. Also keeping tab on risk management and cost plan.

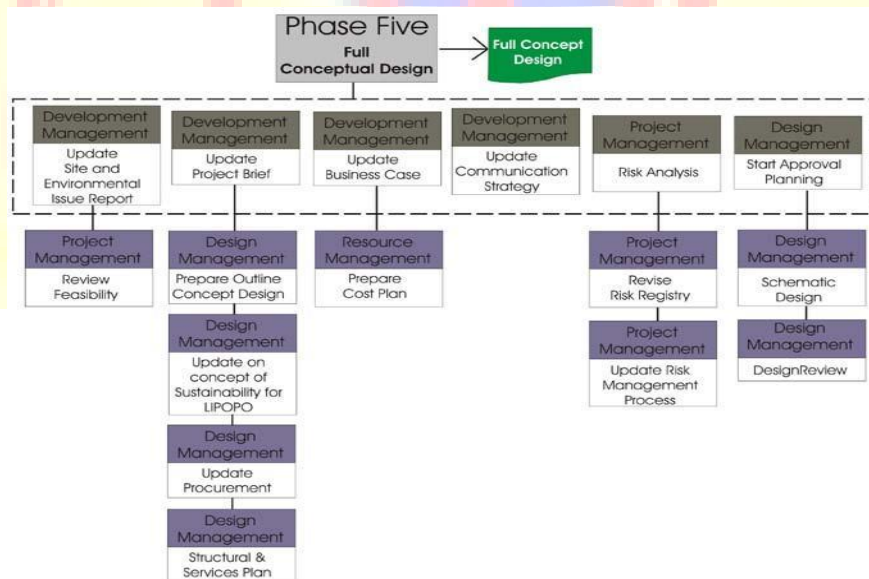


Figure 14: The Process Protocol- Phase Five

Phase Six- Substantive Feasibility Study & Outline Financial Authority: This phase is after detailed planning approval. Besides regular update on various design and business cases, this phase is also about producing product model.

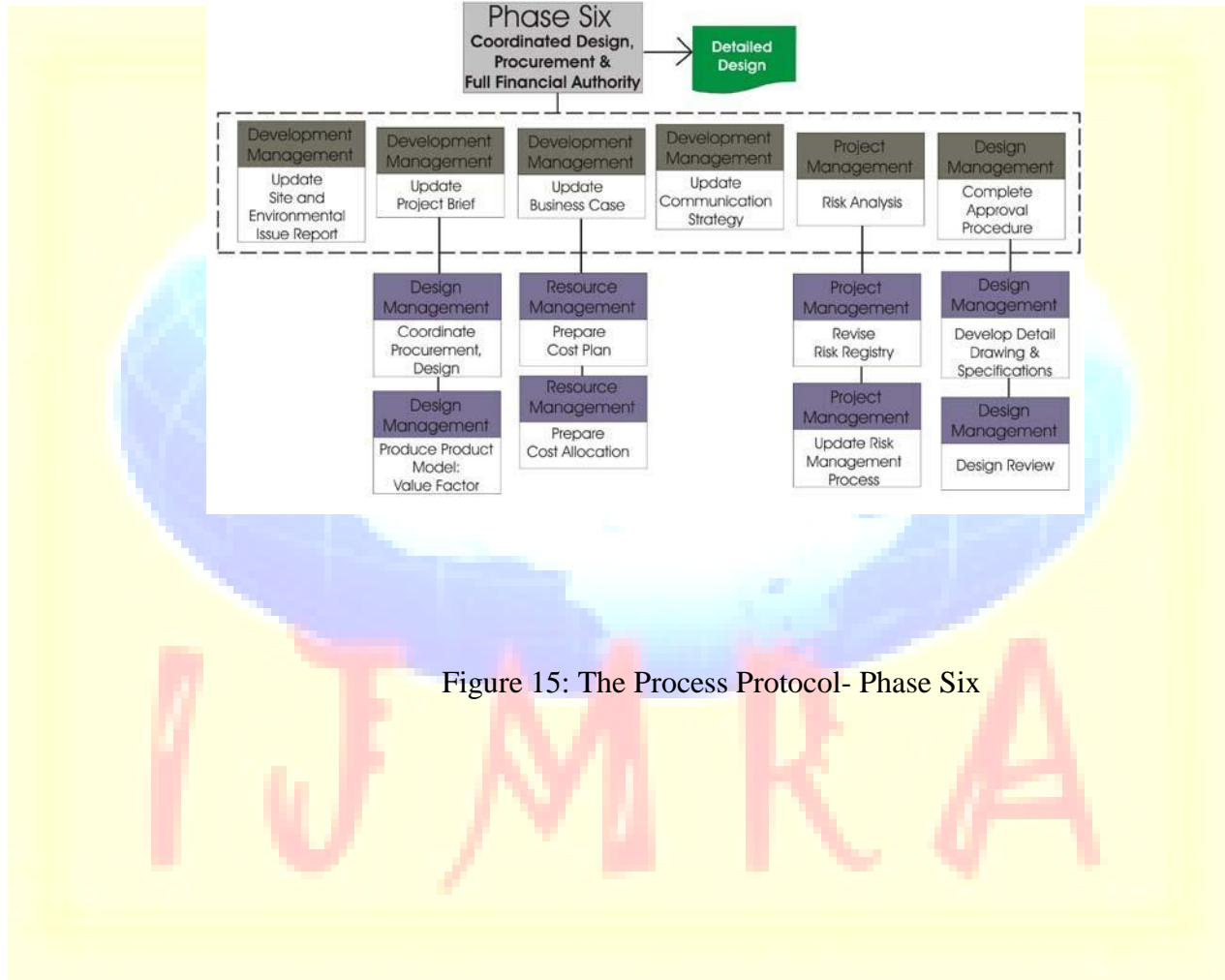


Figure 15: The Process Protocol- Phase Six

c. Construction Stage: The actual construction on site happens in this phase.

Phase Seven- Production Information: Finalization of design, business and cost plan since the next step would be on- site construction. Also comes the monitoring of cost and quality for the project. Sub-contractors would be chosen properly and enabling work would start.

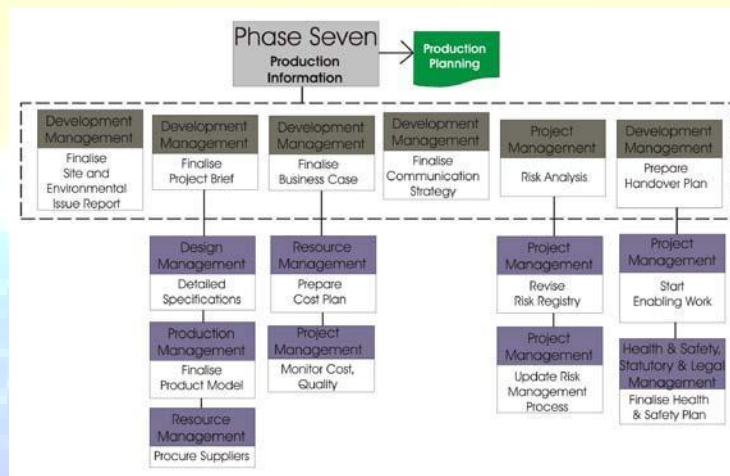


Figure 16: The Process Protocol- Phase Seven

Phase Eight- Construction: After handover plan, actual construction begins on site. In this phase, besides the construction, management of resources is also important. There would be representative from each management field to monitor the progress of the work as according the plan implemented till now. Progress report would be made and discussed every month and also management meetings would happen after every two months on the shaping of the project.

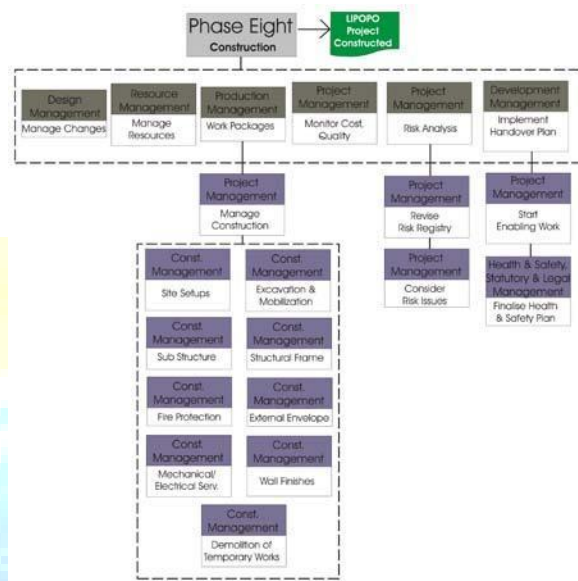


Figure 17: The Process Protocol- Phase Eight

d. Post- Completion Stage: To check and manage the need of built project.

Phase Nine- Operation and Maintenance: Undertaking of project review which can further help into future project of such nature and checking what went wrong and what went right during the course of project execution. Also initiating review of project risk and the way it was handled.



Figure 18: The Process Protocol- Phase Nine

### 3.2.2 Importance of Activity Zones:

These are multi functional zones representing structures set of tasks and processes which guide and support work towards a common objective. For example, Design Management team in LIPOPO map for Process Protocol, who would be working on appropriate design solutions throughout the time period of project from initial sitting with client to make design brief, then updating and revising of design brief all through the different phases. Also each and every activity zone would be in regular communication to other activity zone during project at each and every stage. Not only it improves coordination between activity zones but also implies the fact that each one of these zones are inter dependent on each other. For example, Facilities Management will work well with Design Management on the issues of services in the project and the inputs and knowledge sharing would definitely benefit the project.

### 3.2.3 Document/ Knowledge Management System:

The aim of Knowledge Management System is to carry out and learn from the previous phase of the project phase through Phase reviews.

### 3.2.4 Client Liaison:

LIPOPO, as a client is by far plays the most important role in the whole project. Client involvement in the any project is crucial especially during the briefing stages. Salisbury (1990) summed up briefing as: “Briefing is the most important contribution the client can make to the building project. It is a creative as anything the architect or any other designers subsequently do. This does not mean that it is a short term activity to be got out of the way quickly.” Similarly important is the connection with client throughout the project. A Client Liaison band is running throughout Process Protocol in LIPOPO project emphasizing the need to involve LIPOPO in each and every phase since client’s approval is real y very important.

### 3.3 Merits and Demerits of Generic Process Protocol in LIPOPO:

Generic Process Protocol is inspired on the principles of manufacturing sector where process thinking and continuous improvement has been focused. In addition to that there are various principles related to recognized problem areas in construction and hence suited for LIPOPO project.

Looking at whole project view is an important issue; from the initial need for the project to construction to finally to finished product. This can be of great advantage to LIPOPO since it will ensure that all issues are considered be it business or technical and also accentuate the inter dependency of various activities. The 'stage gate' approach in Process Protocol will act as a key indicator in LIPOPO project allowing it to progressively move forward with constant fixing and approval of information throughout the process. Aouad *et al.* (1999; p.8) mentions that "The Phase Review process induces a continual checking and approval procedure. Whilst this may be seen as an unwanted stop-start procedure, the managed and explicit nature of this process eliminates the 'surprise' element which induces risk."

Poor communication and coordination is one of the most recognized barriers in construction projects and should be handled with care in LIPOPO project as well. Half the battle is won, when right people are in the project for right job as project success heavily relies upon them. The active involvement of all participants in early phases of a project helps promote team work and timely communication.

LIPOPO project talks about sustainability issues and energy efficiency, therefore is a need for project flexibility which can be achieved through Process Protocol as it has ability to add or remove processes. Since the whole idea of Process Protocol is continuous improvement, it perfectly acts as a medium for LIPOPO to achieve its sustainability design goals.

Since, LIPOPO is part of Department of Energy, UK; there would be need of such projects time and again in the future. The Phase Review Process from Process Protocol in LIPOPO would be of great help for any kind of future referencing wherein the project experiences can be recorded, throughout the Process, thereby informing later phases and future projects resulting in potential for risk reductions and improvement in performance.

Furthermore, the Process Protocol model is not biased towards any particular sector or profession which comes as in Activity Zones where each one of has its own role to play and sometimes are interdependent too.

There are some problems also identified with The Process Protocol in the construction project.

The Process Protocol heavily borrows from manufacturing sector's principles, which is a good point but it has some disadvantages also. There are common philosophies in process and production systems that are applied to both manufacturing and construction industries. But there is little argument against the claim since at the end of the day, both are two different sectors and hence some principles working in one may not work in another. For example, majority of activity zones are self explanatory but for the process and change management. For LIPOPO's SCC Project, the idea is about looking at the project as a whole rather than enactment of products at various points as it happens in manufacturing sector; which is the case for the process management. Construction is such a sector where the product, i.e. the project is fixed to the point. The work of process management can be carried out by project manager throughout the process and focus towards common goal congruence. Similarly, the role of change management is also done by various parties involved in the project during different phases.

Addition of Value Management can add to the activity zone in a positive way. Kelly and Male (1992, p.158) describes Value Management as "a service which maximizes the functional value of a project by managing its development from concept to completion and commissioning through the audit (examination) of all decisions against a value system determined by the client".



The importance of getting value for money has always been in the mind of the construction industry from ages and that lead rise to Value Manager who carries out different function during different courses of the project and keep a check on the site which leads to value. Value can be from initial phase level to feedback stage which emphasizes the need for it throughout the project. Since, Process Protocol has defined carious activity zones in it; the addition of Value Management can further benefit it in the construction projects.

It won't be wrong to say that the Process Protocol would be bit complicated to non-computer literate user. Even though it makes work much easier and is definitely a big benefit, it does require a high knowledge of computing skills which might be difficult for normal laymen.

#### 4.0 Production Activities

**4.1 Waste:** For successful output in LIPOPO project; identification of key production activities is necessary like value-adding and wasteful activities. Identifying wasteful activities and then eliminating it in the project creates a value.

Ohno (1988) identified the following seven wastes:

- i. Waste of overproduction;
- ii. Waste of correction;
- iii. Waste of material movement;
- iv. Waste of processing;
- v. Waste of inventory;
- vi. Waste of waiting;
- vii. Waste of motion.

In above wastes, the first five refer to the flow of material, the two last ones to work of men.

Overproduction of material is common wastes, wherein it leads to excessive storage and lead time. Many a times, products do get damaged but it is still practiced to be on the safer side.

In LIPOPO, we would be having our in-house design consultant and be in constant touch with the client, so that design does not suffer and it does not lead to mistakes in drawings while implementing it on site. Lack of information, insufficient details are few of the common wastes that happen from the design team, which leads to waste in time correcting it and executing it on site.

Besides above mentioned seven wastes by Ohno, there could be other wastes which should be taken care of during the course of the project, for example: the waste of pollution. One of the key features of LIPOPO is to make it energy efficient, and if there is waste of pollution during construction, not only its hampers environmental y but also raises the question on image for such esteemed project.

Similar is the case of using excessive energy or power during construction. Energy is big concern in the world today. LIPOPO project's has large concern over it considering the computers it houses which ask for sizeable energy demand, therefore asking energy efficient design.

Consideration should be given to wastes of spaces, both in design and construction site; which can be eliminated with proper planning and controlling.

For making LIPOPO project absolute success, each and every mentioned waste should be avoided and eliminated.

**4.2 Value:** The idea and definition of Value changes from client to client and on situations. The idea of adding value in LIPOPO project should be throughout the project, in all the stages.

Implementation of Lean thinking in LIPOPO will gain benefits and add value to project throughout since few of the principles of lean thinking focuses on maximizing value and minimizing wastes.

Since the procurement option chosen for LIPOPO project is Design & Build, the idea of integrating on design and construction does yield better results like reduction in lead times, quality increase, and profit for supply chains and improved values for LIPOPO as a client, users and society.

Principles of lean manufacturing such as Just in Time (JIT) and 5-S rules can be adopted in LIPOPO project.

Vonderembse and White (1996, p.639) define Just in Time as a philosophy of operation that seek to maximize efficiency and eliminate waste in any form, influencing all parts of a company, including purchasing, engineering, marketing, personal and quality control and even data mining the relationships along the company, its suppliers and its customers.

That means for LIPOPO project focus would be on getting right items on right time in right amount with work being carried by right number of people with right skills.

Material and resources planning is tricky issue in construction process. The building material selection are of very high standards for LIPOPO project, so getting it from trustable suppliers with decent prices and using it in site directly will garner value.

Liker (2004) describes the 5-S as Seiro(remove), Seiton(organize), Seiso(keep clean), Seiketsu(standardize) and Shitsuke(respect the rules).

Each and every S has its own purpose. Seiro's philosophy is removing any unneeded cluttering in the operation area as it can slow down the activity. Similarly organization of items is a way to reduce time for later activities and so is keeping clean and standardization. Respecting rules allows flow of work in a required manner, hence the fifth S.

This can not only benefit LIPOPO project not only on construction and site level but also on management level as it implies on being rigorous, organized and efficient during the whole course of the project.

But implementing lean is also not without risks content. Waller (2003, p.483) does states that it requires much disciplined workforce, minimum inventories and should be severely systemized.

That requires very good planning and processing of all the activities carried throughout the project; hence the first step is process mapping.

Looking at the design part of the project, the use of modular architecture style and pre-fabricated construction seems like a good option. The units would be brought from outside and then assembled on the site. This would work for LIPOPO project as the project goals of LIPOPO's SCC matches with the idea of such design. Such design reduces on-site build time, maximization in efficiency and precision. It gives flexibility for design and finishes. And the biggest advantage which works in its favor is in accordance to LIPOPO project goals, i.e. Energy Efficiency. It nurtures the use of renewable materials and have high energy efficiency ratings and low carbon impact. Also can be incorporated high quality insulation and air filtration. Jefferis and Madsen (2006) further supports this type of construction by stating that this all can be achieved without much additional cost and it increases comfort while reducing energy costs.

Security is a big issue for LIPOPO project; hence money saved throughout the project can be fully utilized on this factor. It should be incorporated in design also; with clear demarcation of

public, semi-public and private areas in the drawings. The private areas are to be highly secured and safe.

In broad sense, it won't be wrong to say that planning project well, with proper monitoring and controlling of cost and time with appropriate quality itself is a value-adding activity. Similarly avoiding risks at all stages of the project can be considered a value and so does eliminating wastes of any kind.

#### 4.3 Conclusion:

LIPOPO's Strategic Computing Complex is very critical and important project for construction body considering the issues it deals with like safety and sustainability. Thus is the need for proper and precise planning and focus on stages and processes very critically.

While RIBA Plan of Work does work for the project, it is The Process Protocol which delivers better for the given project of LIPOPO. The Process Protocol deals with in-depth focuses on stages and phases and relating with activity zones giving out the proper idea of work division throughout the project. Though, it does have its fair share of demerits, but its advantages are far more in comparison.

Talking about production activities, every client defines a successful project as the one which gives "value for money", hence reinforcing the importance of value-adding activities in the project. On the other hand, wastes of any kind should not be neglected in the construction project also and that should be one of the focuses for LIPOPO's SCC project, since we believe each waste removed will be a value gained. Adoption of Lean Construction which also follows manufacturing sector like the Process Protocol can benefit the project, but need for strong discipline throughout the project is equally needed.

**References:**

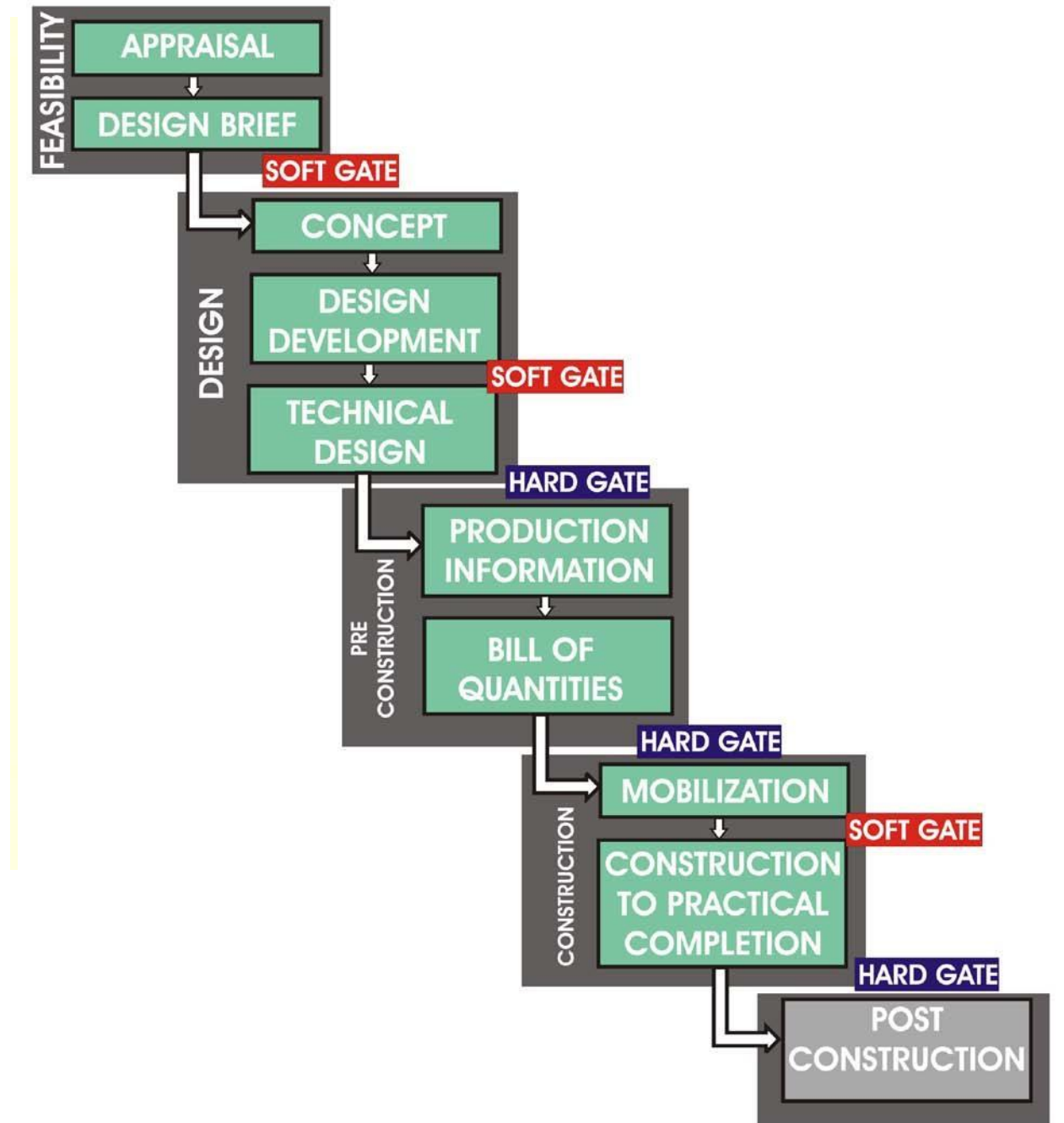
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PART 5

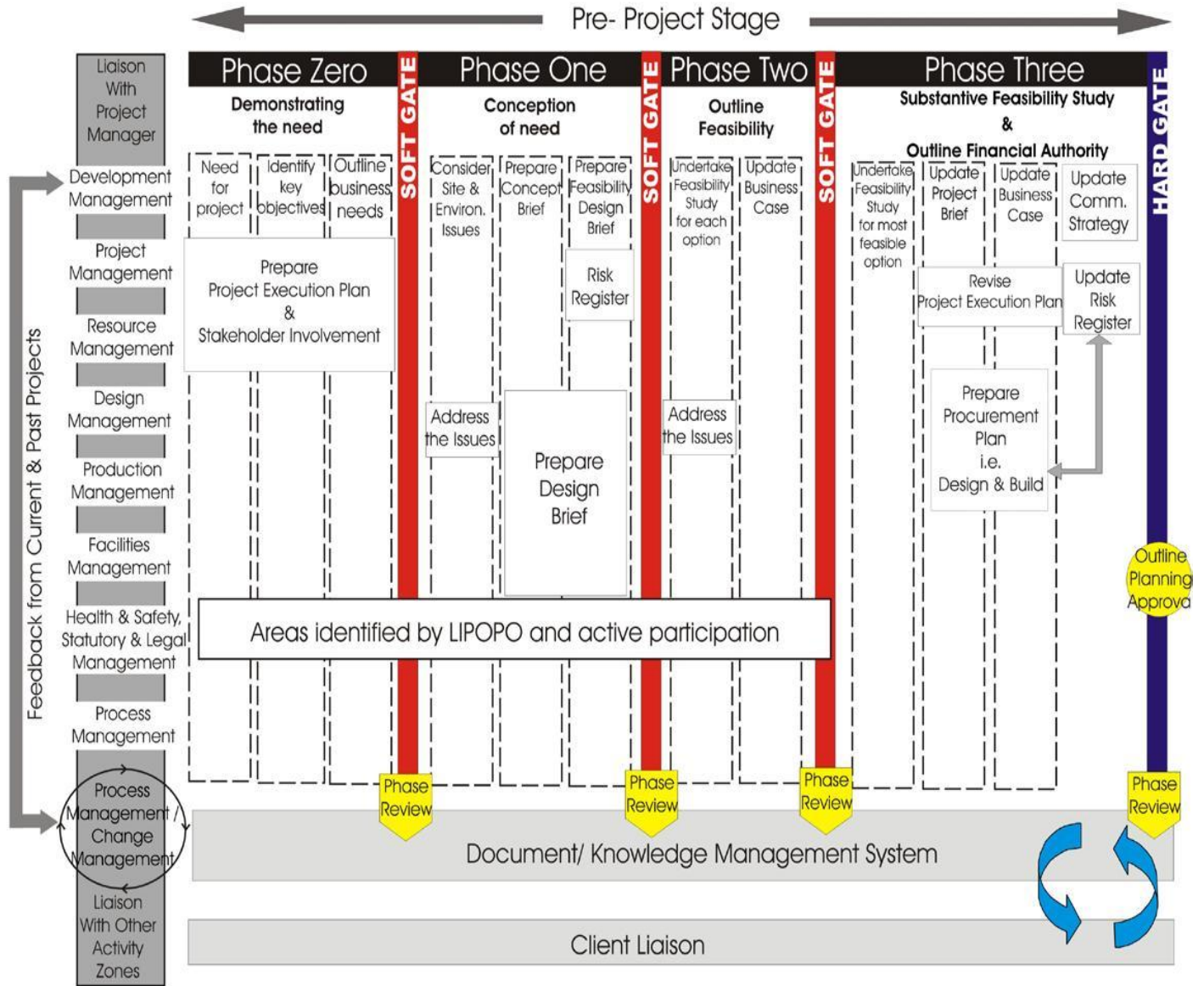
APPENDICES

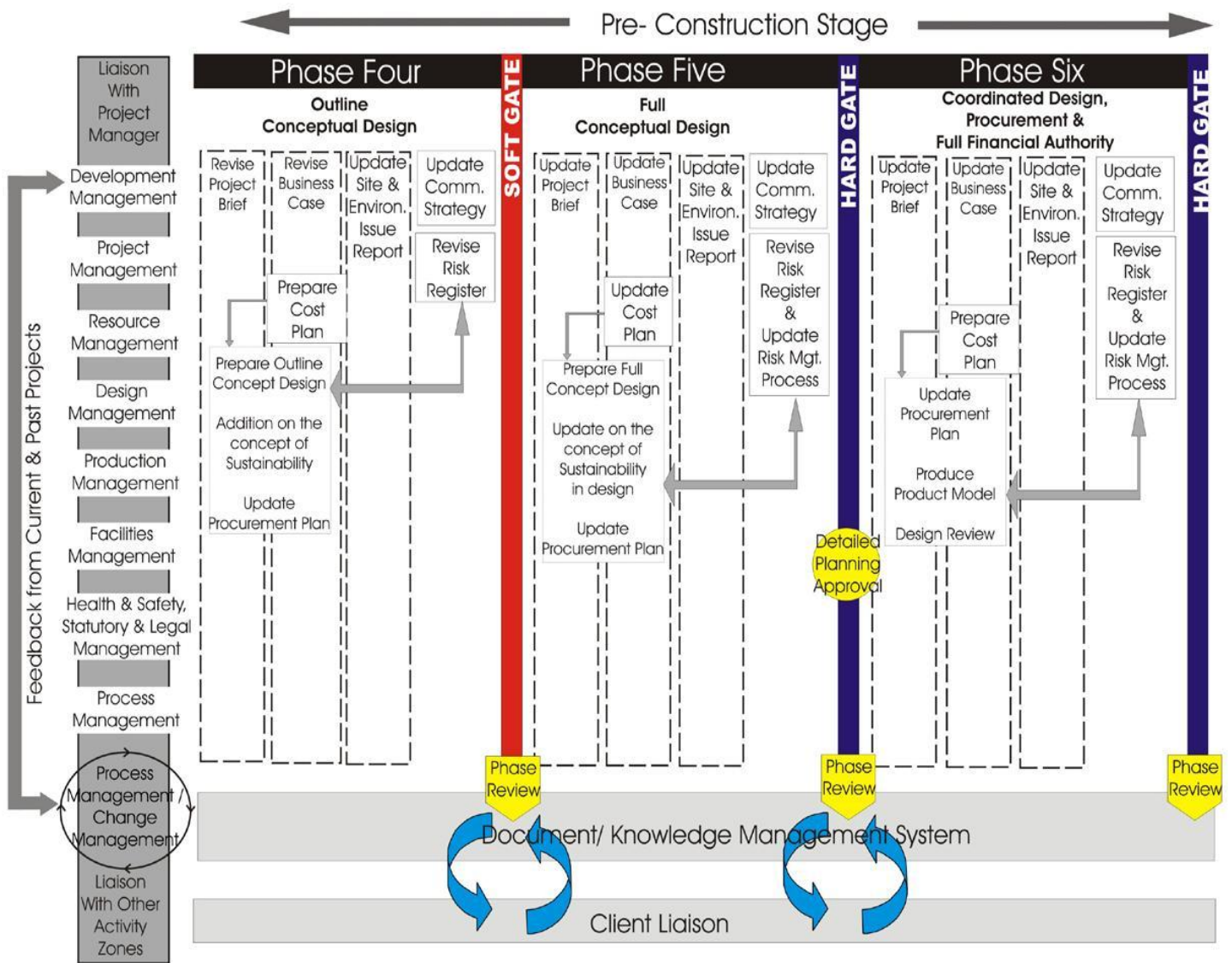
5.1 RIBA Plan of Work

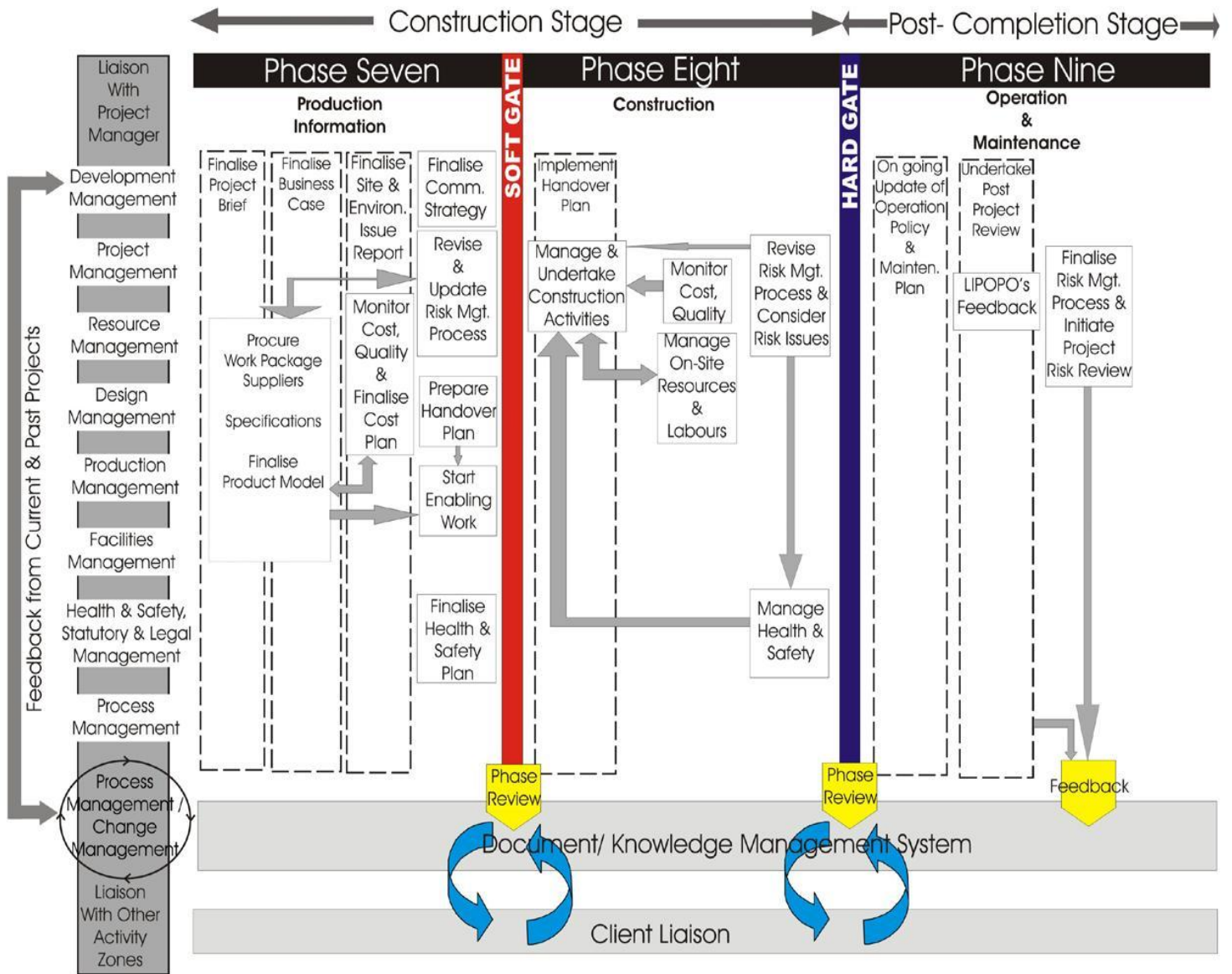




5.2 The Process Protocol







5.3 Detail of the Process Protocol

