

APPROACH OF STANDARD DESIGN MODELS IN THE SAUDI MINISTRY OF INTERIOR PROJECTS

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Abstract: Construction is one of the major industrial sectors of the Saudi Arabian economy, accounting for 6.6 per cent of Gross Domestic Product (GDP) in 2004. There has been a steady and rapid increase in both number and size of building construction projects during the past decade. However, there have been concerns regarding achievement of high performance and value for money from these projects. The Saudi Ministry of Interior (SMOI) is responsible for providing security for the lives and properties of the citizens. The Ministry has a 20-year strategic budget of £4,515,738,575 for constructing buildings such as police stations, civil defence, hospitals, etc. In order to improve projects performance, the SMOI has recently adopted the use of Standard Design Models (SDMs) which have the same specifications, materials and quality requirements. However, many of the projects currently under construction still suffer a range of performance failures such as, completion delays, breakdown of execution and dissatisfied clients. This paper summarises the initial findings of research that sets out to develop a dynamic framework for improving the performance of the SMOI's SDM-based projects. The paper discusses the experience of SMOI in adopting SDMs, explores the process used to produce such models and the expected benefits of using these models. The main conclusion suggests that the SDMs used by the SMOI indeed have tangible benefits that are leading to improved project performance in the construction industry.

Keywords: Project performance, Construction Industry, Saudi Arabia, Project management.

1. INTRODUCTION

The construction sector plays an important role in the Saudi economy and is closely related to other economic sectors. It is also regarded as an important and reliable indicator of the trends and health of the national economy. However, there is considerable variation in the performance of contractors in the Kingdom and there are only few construction companies that meet international standards (MOEP, 2007). It has recently been recognised that the performance of classified contractors has improved due to the higher standards being required by Clients and the need to survive in competitive markets. The Ministry of Economy and Planning has suggested that there is a need to apply many new criteria to improve performance, requiring the development of effective regulations, improvement of management and technical qualifications of staff and encouragement of contractor specialisation (MOEP, 2007). Although a number of contractors in the Saudi Arabian construction industry already perform very well, particularly when they are encouraged financially, i.e. with regular payments, many small and medium companies are often responsible for project delays and poor quality work. These have been attributed to non-availability of adequate financial resources, credit facilities or other financing instruments to improve their capabilities (MOEP, 2007). Nonetheless, Bubshait (2003) argued that the use of

intensive/disincentive (I/D) contract provisions encourage contractors to effectively manage and control project duration and/or project cost, as well as labour productivity.

Recent research work by Arain *et al.* (2006) on constructors' views of the potential causes of inconsistencies between design and construction in Saudi Arabia revealed that success in completing building construction projects depends mainly on the existence of strong and proper coordination, and cooperation and communication amongst all parties involved in the project. Particular attention was paid to the high level of communication between designers and contractors, and this was considered a key factor in the assessment of project performance and success. Furthermore, Arain *et al.* (2006) also reported that in order to achieve maximum project performance, there must be a significant presence and participation of the designer in both the design and construction phases. In addition, there should be a sufficient level of awareness by the designer regarding availability of materials and equipment. Unclear or incomplete plans and specifications for projects can also lead to delay and poor performance. Assaf *et al.* (2006) studied the causes of delays on large building construction projects in Saudi Arabia and established that change orders ranked the highest among causes of delays in projects, followed first by ineffective planning and scheduling, and then poor site management and supervision by the contractor. This paper describes the process for adopting the SDMs and presents its aims and objectives. It begins with a review of the SMOI and its departments, details the number of proposed projects followed by an exploration of the aims, objectives and various stages of the SDM approach, and the expected benefits of the approach.

2. THE STANDARD DESIGN MODEL APPROACH

The Kingdom of Saudi Arabia is one of the world's largest countries in terms of land area, estimated at about 2,250,000 Km², and comprises 16 administrative regions. The SMOI is one of the largest organisations in the Kingdom of Saudi Arabia and, according to the Development Projects Center (DPC, 1999) report, has 17 security departments, each of which contains a number of sub-departments. Over the last decade, it has faced many problems regarding to the need for many and sometimes very large buildings to house its departments. According to the DPC (1999), the number of projects being considered by the Ministry is estimated to be around 3600. The Ministry has also made considerable effort to cover all the different parts of the country with security department offices; each department needing to be housed in a separate building due to their distinct roles.

The large number of projects has prompted the SMOI to create a flexible design system, where changes are allowed to fit local needs. The SMOI has thus sought standard solutions to avoid huge expenditure in its projects. This target is being achieved through a new strategic approach in the form of a long-term plan over the next twenty years, divided into five stages with each stage spanning four years. This approach is named the Unified Proto-Typical Designs, herein referred to as Standard Design Models (SDMs), for SMOI buildings. The approach was created for executing the SMOI plan that focus on constructing all buildings needed by the SMOI departments. It involves launching different types of design models which are intended to be re-used over a number of projects. This system has many advantages

regarding the uniqueness of its designs and the reduction of design costs by using only 85 standard design models instead of 3600 buildings being designed in isolation, thus representing huge financial saving for the Ministry. The system has also helped to: introduce Unified Standards for materials, specifications, building forms; and control operations during the construction phase. In the long term, the strategy is expected to achieve significant benefits in terms of lessons learnt, develop Unified Standards for furnishings, reduce procurement costs through a more strategic approach to bulk purchasing, improve supply chain management and reduce maintenance costs. This research will contribute to the attainment of the long-term benefits aimed at improving the performance of the projects.

3. GENERAL AIM OF THE SDM APPROACH

This approach aims to produce SDMs for SMOI projects, by stressing the importance of reducing design and construction costs, increasing quality, improving procurement and effective monitoring the construction phase (DPC report, 1999).

3.1 Pre-construction activities

The DPC report emphasised the importance of clearly identifying and articulating the needs of the projects prior to the commencement of construction has been recognised and the process below has been developed and adopted to ensure that this is achieved.

- 1- Determine the SMOI department's needs for the building.
- 2- Estimate the overall amounts, which are spent annually on rented buildings.
- 3- Identify all rented buildings.
- 4- Study all the buildings owned by the SMOI.
- 5- Study all the land owned by the SMOI.
- 6- Estimate the amount of land required for these building projects.
- 7- Distribute to, and collect from all sectors, the requirements of the approach.
- 8- Implement the design phase through engineering consultants.
- 9- Ensure the practical application of SDMs on projects to be put out to tender.
- 10- Invite contractors for tender.
- 11- Ensure readiness to start the construction phase.

3.2 The expected benefits of the approach

The DPC report also identified the expected benefits of the approach as follows.

- Programming of projects according to priority and a specific plan based on the building, whether it is government-owned or rented, and availability of land.
- Approval of the Ministry on beginning these projects according to the plan.
- Best designs are obtained for the least cost.
- Reduced project execution cost.
- Reduced maintenance and operation costs.
- The need for requested land for the Ministry projects being demonstrated.
- Flexibility in updating the designs and specifications for the unified model.
- Flexibility in assessing these designs after implementation in projects, and avoiding the defects, if any, in future projects.

- Flexibility of convincing the end user to reduce the models based on actual needs that will appear clearly after completion, and apply this to future projects.
- Evidence to convince the Ministry of Finance to increase the budget allocation of some projects due to their repetition.

4. STAGES OF THE APPROACH

This section aims to describe the process used to produce the SDMs as shown in Figure 1. It seeks to detail the stages that are to be followed in order to achieve the main target of SMOI plan. These stages involve drawing up a comprehensive inventory and requirements list, design, adaptation of the SDMs to the site, tender and construction (DPC contract, 2000).

4.1 Comprehensive inventory and requirements phase

4.1.1 Comprehensive inventory

To ensure better working practice, a comprehensive inventory has been built up. This involved designating staff across the country to collect the information required from each department. Specific applications were designed to gather this information. The main target of the inventory was to provide a clear figure relating to the number of items owned by each department. It also provided information about the level of expenditure on rented buildings and the current status of buildings belonging to the SMIO. In other respects, the building priorities for each department could be identified according to greatest need. Many significant challenges have faced the SMOI regarding the availability of the land it owned and these were made clear by this survey. Hence, the priorities and needs for each sector of land have been identified. As a result, there was successful coordination between the SMOI and the Saudi Ministry of Municipality in finding land for the planned projects and avoiding obstacles that might introduce delay. Future needs for projects relating to each department can be added to this plan as they emerge. This task includes the collection of all documents related to Ministry possessions, which may need to be reviewed further, in order not to hinder any future plan's success. Ultimately, it provided a good database for all information related to Ministry possessions, which helped in drawing up the SMOI's long-term plan.

4.1.2 End user requirements

The distribution of requirements over all departments was carried out to build a database of all information related to building needs. The major aim of this task was to gather information considered very important in preparing the SDM for a target project. The collected information provided the means to identify the necessary elements pertaining to project components for all departments. These requirements were subjected to many processes in order to ensure rich data gathering.

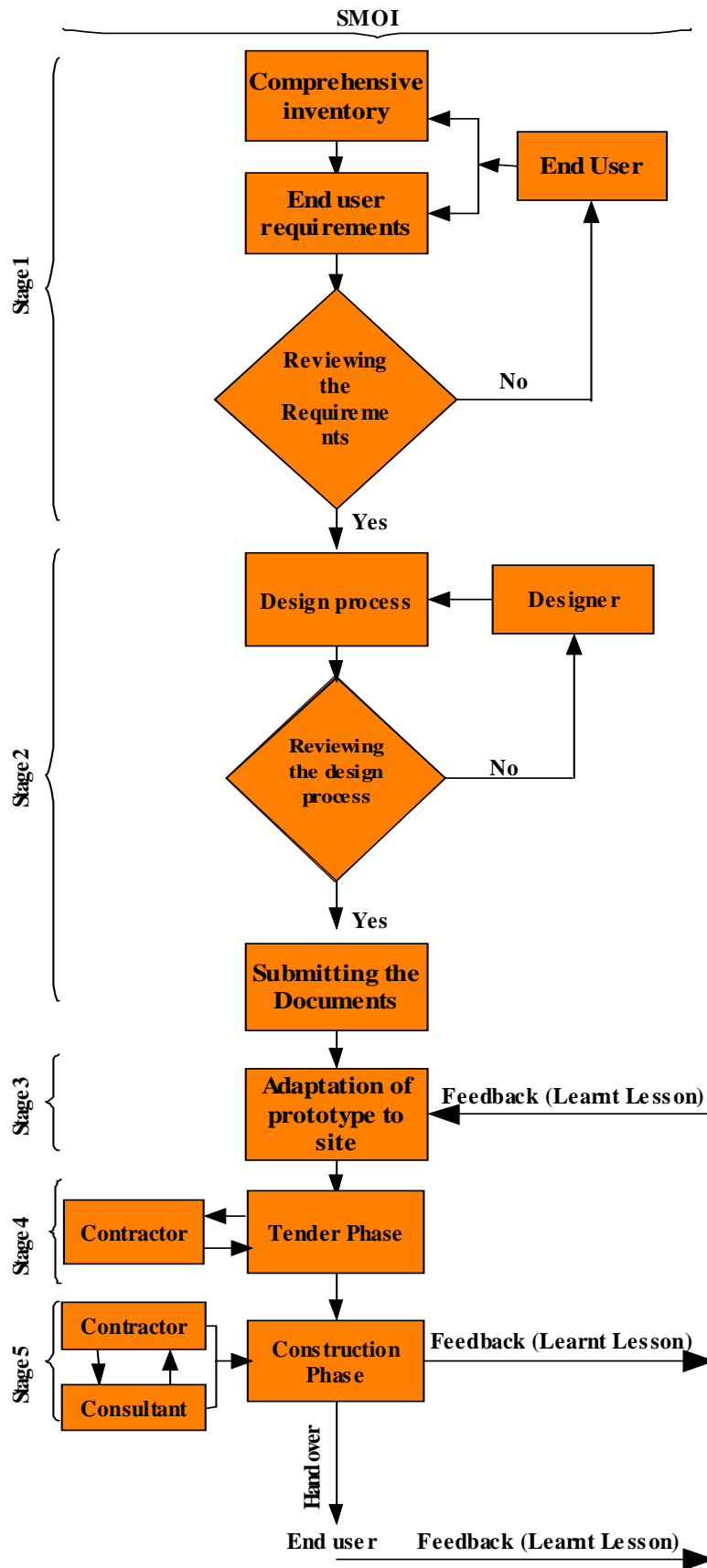


Figure 1: Standard design models process

4.1.2.1 Collecting the relevant information regarding the SDMs

The aim of this task was to gather relevant information regarding the preparation of the design model for the target project including the following.

- General information.
- Information about the administrative system.
- Information about needs and requirements.
- Support services.
- Information about the site.

4.1.2.2 Monitoring implementation of information gathering related to the SDMs

This phase aimed to: fill in any incomplete information related to the SDMs; discuss, perhaps, over-ambitious requirements and needs; establish the relationships between design elements; determine future requirements; and eliminate any shortfall in information as indicated in the first statement. This will take place through meetings with authorised people in the relevant departments to cover the following points.

- General information.
- Discuss of the exaggerated needs and requirements.
- Identify the working relationship between different directorates, departments and units.
- Fill any information gaps through discussions with the end user and the technical team.
- Adapt this information to the particularities of a specific site's situation.

4.1.2.3 Collecting additional relevant information regarding the SDMs

This statement refers to gaining additional information regarding the design model, particularly administrative and technical information, which included the following.

- Information regarding staff working overtime.
- Number of entrance gates.
- Information about security requirements.
- Information about electrical requirements.
- Information regarding fire safety systems.

The outcome of the above task provided useful information, which formed a basic model for the requirements of all departments. Moreover, this information enabled the specialists to map the design process and supported the idea underlying the need for SDMs. The information gathered was reviewed to provide a database for the design phase.

4.2 Feedback on requirements approach

The participation of the end user is critical for the SMOI and is one of its priorities. The aim of feedback is to ensure that all comments sent by departments are filed in accordance with applications. Many meetings take place between all relevant parties to discuss and resolve any issues or ambiguities, which might lead to mistakes in the design phase. This part of the process results in significant end user satisfaction with respect to requirements. The information gained from the above process provides

guidelines for planning the design phase. A comprehensive review covers all details which are related to design elements in terms of area, number of floors, relationship between divisions and any special needs related to functionality of building. The reviewed information are documented and prepared as official documents ready for tender. The next step involves grouping the design phase into three groups based on a number of criteria such as the amount of money paid in rent, the availability of suitable land, the importance of the project, particularly with respect to the facilities provided for people. These criteria facilitate the coordination and agreement with the Ministry of Finance, in order to fund the planned projects, and many attempts are made to ensure the estimated budgets for all projects are obtained. This process offers a crucial insight for specialists, since it identifies the total requested land area, as well as the number of projects, as criteria for estimating the number of re-usable models for the present and future.

4.3 Design Phase

According to the DPC contract (2000), the SMOI wants to have Unified Standard Designs for Departmental Buildings surveyed and prepared in accordance with the contents of the Special Conditions of the contract documents. All of this, according to the aforementioned process, involves the documentation of all requirements and drawing upon the expertise of highly qualified specialist design engineers. This phase starts with a number of meetings with the consultants in order to discuss and draw up a detailed needs analysis. It also involves agreements on the regular meetings between the SMOI and the consultants. Although the end user only participates in the previous stage, the SMOI nevertheless attaches great importance to this participation, since it appreciates the vital role end users play in ensuring the success of the project. Requirements for the consultant are linked to the Ministry's requirement for Unified Standard Designs for Departmental Buildings, which can be implemented by the Ministry over different periods and in different places, in all regions of the Kingdom. Therefore, the consultant shall be obliged to prepare Unified Standard Designs for Departmental Buildings as specified in the needs analysis, and will take into consideration the following.

- While preparing these standard designs, usual (analogous) circumstances shall be taken into consideration.
- The design modifications will be prepared for the approved standard designs and to allow for any possible variations in nature and circumstances of the sites, and/or location in an earthquake zone.
- The consultant, after having signed the contract, shall suggest the dimensions of the model site for each category separately and obtain the approval of the Ministry to enter the phase of producing the standard design.

The following are the proper procedures that must be followed in this phase.

- During the preparation of the SDMs, all the standard site considerations are taken into account.
- Take into account all considerations regarding possible variations in sites in terms of relief or seismic activity risks when formulating modifications to the SDMs.
- Provide the suggested dimensions for each prototype design.

- Prepare SDMs that can achieve the flexibility, simplicity, and low cost, as well as the possibility of executing these models over different periods and locations covering the whole area of Saudi Arabia.
- Achieve all the project requirements.
- Study the relationship between project components and attempting to improve the connection between them, by considering the flexibility regarding movement inside the site.
- Consider any future growth.
- Select high quality and locally produced construction materials.
- Select a recognisable and homogeneous style, which reflects the functionality of building.
- During the preparation of the design, consider maintenance operations and their costs.
- Appreciate the social and religious considerations.
- Use the most contemporary technology regarding project preparations.
- Prepare the design to enable savings in energy consumption.
- The final cost should not exceed the initial cost.

The outcome of this stage involves the submission of design documents according to sequential stages, where they are subject to technical review by a committee representing all relevant parties to avoid mistakes at an early stage, and to reduce any defects that may affect the construction phase. SDMs save time and money for both client and designer, because at the design stage, the activity and focus are on one model, where it is subjected to many processes, in order to produce a perfect model. These processes involve providing a number of models for the client to review the architectural aspects and then select the best and most suitable model. After that, the selected model will be subjected to a structural review, mechanical review, an electrical review and a civil review. Eventually, at this stage it is possible to produce a number of re-usable models of this type. The SMOI thus establishes a new idea to adapt the SDMs to be suitable for a new situation.

4.4 Adaptation of SDMs to site

According to the DPC contract (2000), the SMOI implements the SDMs in any required project, by adapting these models to individual sites. It is considered one of the key stages for ensuring the success of the approach and in order to execute the comprehensive development plan drawn by the SMOI. To achieve this aim, many procedures are required in terms of survey data, soil investigation and the necessary design adjustments for each model.

4.4.1 Adaptation of SDMs to individual sites

The ability to adapt the SDMs is very important to the SMOI. There are many common issues involved in fitting the model to the site, such as: area, soil investigation, the direction of building and the entrances and exits. The following procedures describe the following adaptation stages.

a) Stage 1: Preliminary adaptation to the site

Having done the topographical survey and before conducting a soil investigation, the consultant should conduct a preliminary adaptation to identify all factors that will be changed due to the adjustment of the SDM, such as the number of parking spaces, the area and dimensions of the site, Qiblah (prayer) direction, changes in entrances, suggested services locations, and all other factors in the project. The consultant should then submit this to the Ministry for approval, supported by an initial study explaining the extent of this adaptation.

b) Stage 2: Pre-final adaptation and necessary modifications

After completing the preliminary adaptation, gaining the Ministry's approval and a soil investigation, depending on the previous collected information, the consultant should conduct the Pre-final adaptation and make the necessary modifications. These include drawings and contract documents, identifying the plans that will be modified according to the variables related to the actual site, and where it is possible to start the construction phase. The plans that will be modified are as follows.

- All plans related to master plans of the site in all engineering aspects, whether involving walls, gates, external extensions and site works.
- Foundations and other structural works, according to the soil investigation.
- Air conditioning and electrical works.
- The bill of quantities and specifications.
- All plans which need to be modified.
- Cost estimate for construction.

4.5 Tender Phase

This phase is subjected to the government procurement system, which is based on low-bid selection. This phase starts by inviting bids from contractors through advertisements, where they are given a specific period to return their bids for analysis. Added to the low-bid criterion, are many other criteria used to identify the winning bid, such as: contractor qualifications, previous experience and project cost.

4.6 Construction Phase

According to the DPC contract (2003 and 2004), the construction phase is equally regarded as key to the success of the approach. As a result, the SMOI pays attention to this phase in order to realise the planned benefits of the approach. Moreover, the Ministry established a substantial supervision and reporting contract for the construction phase to help control and monitor this phase as there are many projects awarded annually. Such comprehensive supervision and reporting can reduce client costs, increase quality control, reduce and resolve site problems, improve performance, and ensure timely project completion. The main aim of the supervision contract is to improve project performance through best practice. This can be done by providing all necessary technical views, and decisions regarding the plans, specifications and drawings to the contractor in accordance with the contract documents. The supervision contract involves the following procedures.

- Review the studies, specifications, plans and detailed drawings, and ensure that all are correct, accurate and according to contract, thereby meeting the client's requirements and needs.
- Study and review the approach taken to project implementation, report all comments and discuss them with the contractor, suggest any suitable modifications and take all necessary steps to ensure work progresses according to the approved schedule without any delay for whatever reason.
- Study all technical problems which may arise during the construction phase, propose recommendations and legal solutions to the client within one week during the contract period, where these problems do not lead to a delay in the project.
- Study qualifications of the contractor, supply chain and subcontractor, propose the technical view regarding any modifications suggested by the contractor or client, review and study specifications and drawings concerning these modifications and their impacts on schedule, propose effective ideas that affect project performance.
- Issue detailed monthly reports to the client regarding the progress of the project and the extent to which this progress is in line with the schedule. These reports must be supported by documents, pictures, bar graphs and soil investigation results. The reports must clarify the extent of overall project performance, percentage of implemented works, and the progress of payments.

5. CONCLUSIONS

The SMOI adopted the SDMs approach in order to reduce costs and improve projects performance. This has been implemented for its current and future projects by focussing on a number of considerations such as flexibility in updating the designs and specifications for the unified model. The anticipated outcomes of the adopted approach are: reducing cost of design, delivering project on time, and achieving high quality. Furthermore, this approach provides the opportunity for the SMOI to estimate the whole cost for implementing its projects through long-term plans, which might be a challenging task to undertake in traditional design due to the diversity of building types. As such, it is evident that the SDMs could play an important role in improving project performance and contributing to client and end users' satisfaction. Many lessons will be learnt with regard to design knowledge capture and re-use, and through the concept of adaptation of models to avoid inefficiencies and shortcomings which occurred in previous projects. The use of this approach should gradually materialise as quality of designs and construction processes improve due to standardisation of specifications and materials. Additionally, the procurement systems should also improve, with significant impact on the supply chain. Finally, the SDMs used in the SMOI indeed have tangible benefits that could act as a prototypical model for improved project performance in the Saudi construction industry.

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