REFOCUSING PROJECT DELIVERY SYSTEMS ON ADDING VALUE

Refocusing project delivery systems

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Abstract

The ability to manage a lean supply chain that contains no non-value adding elements is the ultimate challenge. The research behind the paper's findings is based on the production of functional process models adopting IDEFØ methodology to portray information flows, participants, organisations and IT use. Key participants in 11 projects contributed to the research and subsequently verified the models. Analysis was then performed on the models, including checks for consistency and process integrity. A generic model was developed from the best practice elements of all 11 projects, alongside changes in construction procurement and out of sector best practice industrial design and production. The result is a new project generic process model that could form a blueprint for subsequent construction projects. The research continues through modelling and costing different project scenarios so that non-value adding activities can be isolated and eliminated from the supply chain.

Keywords: Process modelling, function modelling, supply chain, value added, value chain.

1 Introduction

Efforts to improve the supply chain in construction are the subject of numerous initiatives within industry in many countries. The potential for process improvement to deliver real savings in cost and time is not lost on the construction industry's clients. Moreover, the prospect of greater consistency in the process, leading to a more certain outcome has raised expectations. Application of lean production principles to the supply chain is beginning to show benefits in terms of time, cost and quality improvement, but more can and must be done.

Quite how much improvement is possible will depend on the extent to which the value stream can be identified and manipulated to deliver against client demands. In the absence of this, piecemeal initiatives will produce sub-optimal results. Attempts at optimising a part of the process without understanding the remainder will not result in serious improvement.

An alternative – and the one outlined in this paper – is to model the entire process for a project down to a detailed level. Opponents may simply say that it is too complex a task to be performed and that, besides, all projects are unique. The research has shown that even across different countries (for example, France, Germany, Sweden and the UK) there is too much similarity for this view to prevail. Detailed modelling of the supply chain, in terms of information flows, participants within the process and the tools they use to communicate – especially IT – has already provided many useful insights. A better understanding of how organisations interact at the project level has emerged and will lead to some remedying of long standing failures. Even so, more has to be done to deliver the order of savings in cost and time that have become enshrined in various national initiatives – see for example, the work of the Egan construction task-force in the UK culminating in the report, *Rethinking Construction* (DETR, 1998); and the Swedish programme, *Competitive Building*.

Preliminary research had shown how even the most basic actions are prone to failure because of information that is not communicated when it is needed, in the form that it is needed and to the people who need it. This merely confirms the problem, but does not necessarily provide firm answers. Further examination suggests, however, that the entire infrastructure for delivering a project has to be taken into account. There are simply too many factors and influences that are being overlooked. In this respect, the research is attempting to establish a generic model of the infrastructure for managing the human and other resources on a project, including the IT.

This paper describes the work to date and outlines the next steps for effecting improvement, through the introduction of cost and time data.

2 Proposed generic process model

Elements of best practice within the 11 projects, which are consistent with changes for the better in the industry, have been identified and are presented as part of a generic process model. Of these changes, *managing client's requirements*, *integrating design and construction as a single process*, *value chain management* and *total project management* are major factors in achieving project success.

The search for best practice has been extended beyond construction to other industrial sectors where lessons can be learned for improving the overall process. The generic process model is, therefore, more than just a distillation of 11 projects. It could be used for benchmarking performance and as a blueprint for future projects that can be adapted to suit the needs of individual clients.

Within UK construction are several current initiatives aimed at process improvement. These include the Agile Construction Initiative (Bath, 1998), Egan construction task-force (DETR, 1998) and *The Agenda for Change* by The Construction Round Table (CRT, 1998). All three aim to reduce cost and time dramatically, whilst raising quality and certainty, and are strongly client focused.

In order to achieve the above, and as a reflection of the elements of best practice distilled from the 11 projects, it is necessary to redefine the life cycle stages. This has produced a sequence that is markedly different to that adopted as the basis for modelling the projects. This has occurred for two reasons. First, many activities performed on the projects do not fit comfortably within the original stages, since they attempt to deal with the unique circumstances of a client and/or a constructor-driven process. Second, the original generic stages do not adequately reflect the emerging structural changes outlined above. For these reasons it has been necessary to reconsider the entire process.

3 Redefined stages

Analysis of elements of best practice and their application to construction has produced the following stages for a generic process model.

1. Project initiation
2. Project definition
3. Outline design
4. Advance works procurement
5. Detailed design
6. General works procurement
7. Production
8. Facilities management

This reduced set falls naturally out of the project analyses and includes all the value adding aspects of current process improvement initiatives and established patterns of work. However, it differs in several respects, not least in its use of terminology that is intended to avoid potentially misleading assumptions about what is or is not included. Perhaps the main differences are in reflecting the concurrent and iterative nature of design and its overlap with construction. The proposed generic model also attempts to align more with a process that is client-driven and for which the ultimate deliverable – the building or facility – is just the beginning of the next phase in the business cycle. Whether or not these proposals become adopted depends to some degree on the extent to which identified changes within the construction industry are seen as threats or opportunities.

The stages are now described with reference to the model. Flows of information are not specifically marked as electronic, since all are deemed to be so.

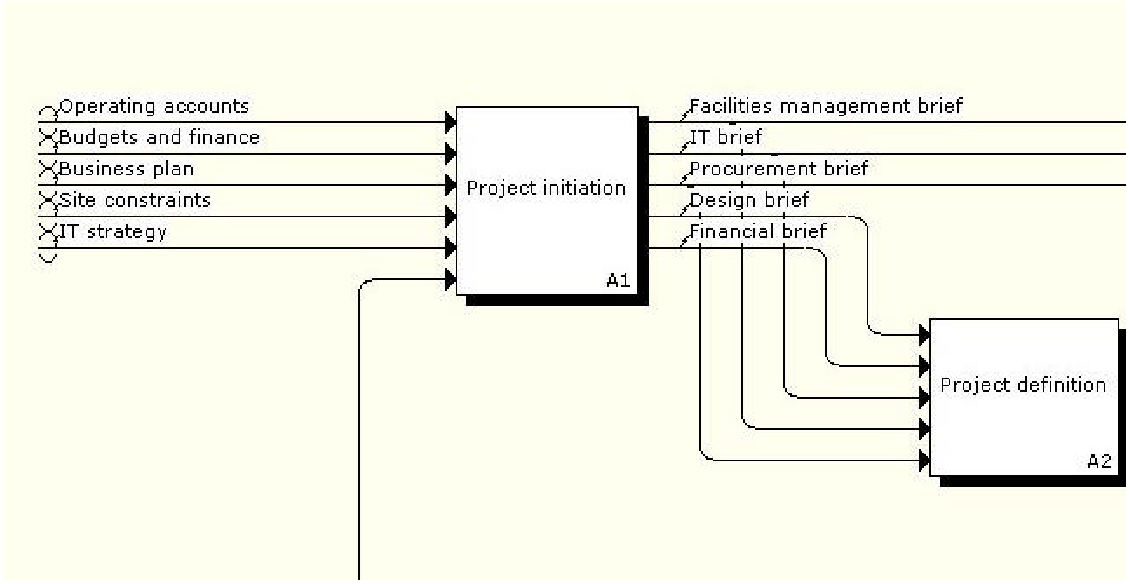

Fig. 1: The first two stages of the new generic process

Stage 1: Project initiation portrays the earliest stages of a project's life where the decision is made to proceed with the idea of a building as a possible solution to the client's needs. From the definition of client's needs, project objectives give rise to briefing. This is often regarded as a single outcome activity, that is, a singular briefing document is produced. Further investigation has revealed how best practice in briefing, both within the construction sector and within manufacturing, considers several different, but interrelated documents. There is the design brief, which will be used, *inter alia*, to express the architectural, engineering and functional requirements of the project. But there are at least three other briefs. Of these, the financial brief is more than a cost plan under the traditional system, since it embodies a breadth of information that is used to set the project on a sound financial footing. Implicit in this is a life cycle appraisal approach to cost planning. Instead of life cycle considerations being added to a capital cost planning approach, they become the dominant features.

Two other briefing documents are produced at this stage, which inform later critical stages in the process. The procurement brief sets out, *inter alia*, the actions, requirements and time-scale for organising contracts and buying work packages. The facilities management brief ensures that matters essential to the successful functioning and enjoyment of the building are brought to the fore and do not become an afterthought. With the growth of public-private partnership projects, it has become clear that the management of the building or facility is a priority concern and one that directly affects funding prospects. Little in the way of technical IT solutions are used or, indeed, needed here. Office automation tools and an effective communications infrastructure will ensure that more order is put into the process.

Stage 2: Project definition is where the form of the project emerges. The first part attempts to produce a design concept that feeds off the design brief. The overall design approach, models and sketches are used to establish proof of the concept. Other primary inputs are the remaining briefs. From this stage emerges a workable design, complete with cost limits and time constraints, i.e. a focus on a design having clear quality, cost and time objectives. Within this stage, separate consideration is given to the several facets of design: architectural, structural engineering, environmental, geotechnical and landscaping. This is also where we see the close interaction of a design value for money function. Life cycle appraisal becomes part of the overall design discipline. It effectively replaces the traditional, external quantity surveying function that ordinarily delays the iterative, convergent development of the design. This is an opportunity for the design discipline itself to achieve greater value for money. This is why there should be a value engineering input. In practice, this could be QSs with an aptitude for design economics and an understanding of constructability issues.

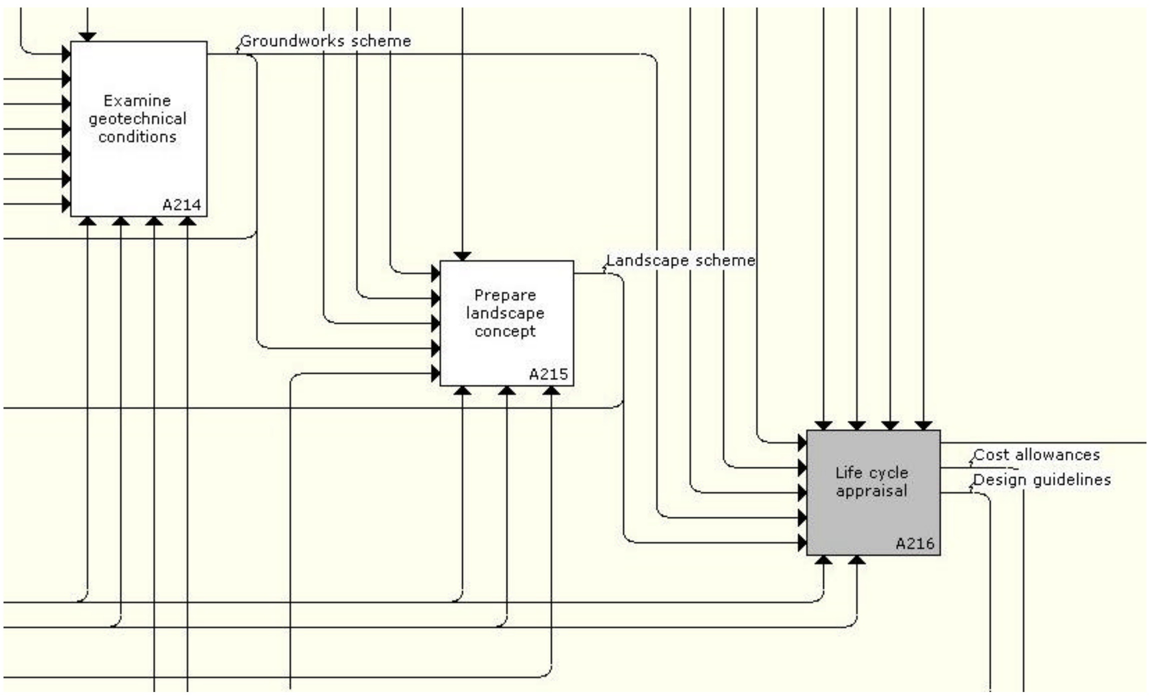

Fig. 2: Life cycle appraisal effectively replaces plain cost planning/checking

The now recognised role of the planning supervisor is brought into establishing proof of the concept. This contribution is integral with that of the value engineer and the design discipline overall. It will also begin the process of ensuring the elimination of accidents. Proof of concept is also where the first applications of value engineering occur – this is something that should be a continuous feature of the design phase. Moreover, it should be design-driven, not left to external disciplines to impose cost and quality cutting exercises.

IT use within project definition is largely a matter of graphics-based systems, (CAD) and GIS. Office automation tools provide the support for most other activities, within an IT infrastructure that enhances communication across the project team.

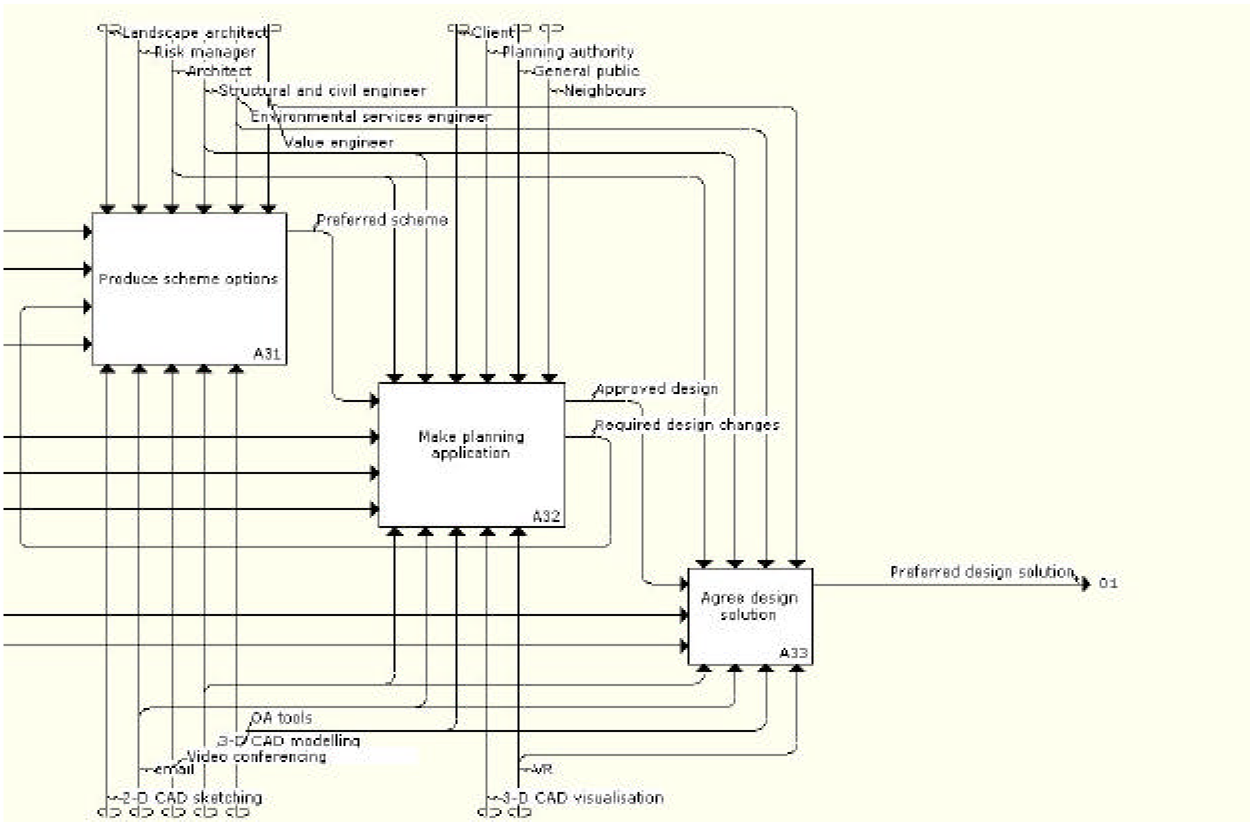

Fig. 3: Using a range of existing IT to establish the concept

Stage 3: **Outline design** is where various design options are explored and from which a single, preferred scheme emerges to form the planning application. Beyond this point a single design scheme can be adopted as the preferred design solution. Throughout this stage are many hidden iterations supported by IT in the form of CAD and other means for understanding how the design will manifest in practice.

Stage 4: **Advance works procurement** deals with the need to commence some parts of the detail design in advance of the generality and which may be the subject of the work of specialist contractors or suppliers. The procurement of such specialist services will have been identified within the procurement brief and arrangements made to negotiate or tender these works. At the operational level, the aim must be to ensure that any external designers do not fall outside the loop of IT use. They must be properly integrated if information is to flow seamlessly. The essence of this stage is that preliminary design will occur in a number of areas. Some practitioners refer to this as *technology clusters* and is reflective of the need to concentrate on major elements of the building having strong connections and for which design and production must be largely concurrent. Five technology clusters are identified here: *frame*, *envelope*, *engineering services*, *groundwork* and *fit out*. IT support is largely the same as in previous stages, that is 3-D and 2-D CAD, office automation tools and a communications infrastructure.

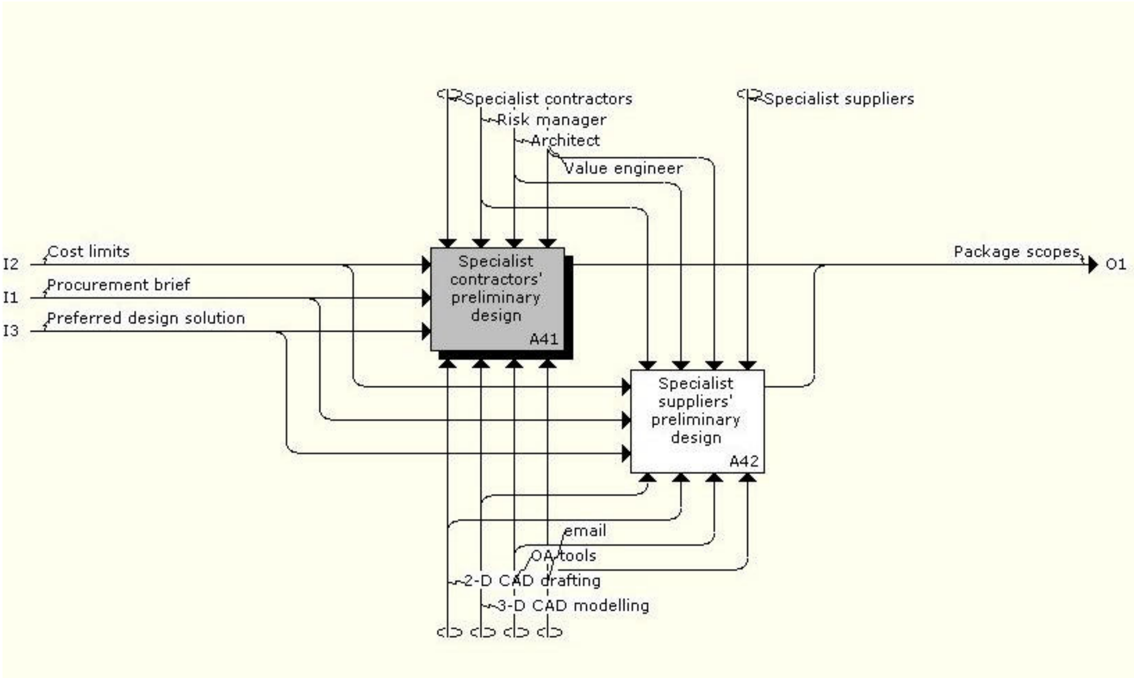

Fig. 4: Specialists must be fully integrated into the process

Stage 5: **Detailed design** draws on developed package scopes alongside the preferred design solution to produce design details. Interface issues are identified and resolved here and a final detail design emerges. This stage is essentially the same as that within the traditional process, except that it integrates the final stages of specialist contractor design with the generality of detail design. As in other stages, there is no differentiation between drawings and specifications. Electronic means have the capability of allowing different forms of abstraction or representation of a design than has traditionally been the case with paper. In other words, the move is away from seeing CAD as a means for simply automating the production of paper drawings and the use of dedicated specification writers. IT uses are, therefore, broadly the same as in previous stages.

Stage 6: **General works procurement** covers what were originally three stages: *tender documentation*, *estimating and tendering* and *evaluation of tenders*. This stage is intended to accommodate the remainder of work packages, although the same basic arrangement could be used for the procurement of specialist works. This could be achieved by linking the procurement brief and preferred design solution outputs from earlier stages to this stage and providing a feedback to advance works procurement. Graphics-based systems are used in the bid package preparation stage, alongside office automation tools and the communications infrastructure which supports the complete effort.

Stage 7: Production recognises the trend towards shifting more of the production off site to factory controlled conditions. Fabrication allows the often long and complex process of off site production to be properly integrated into the totality of the project. It requires a more proactive approach on the part of the project team than has hitherto been the tradition. This stage emphasises also the need to secure evidence of compliance with the specification and other control instruments. Indeed, control over this phase in the overall process will become even more important in future. IT integration is vital. Other aspects of this stage include assembly and commission. These cover the delivery, materials handling, component fixing and the finishing and commissioning of the works. In other words, they are a sequence of activities aimed at ensuring a fully functioning and certifiable building or facility, complete with supporting documentation. This latter aspect is only really likely to be managed successfully if there exists a comprehensive IT infrastructure. Documentation that signifies compliance and provides the means for effecting a smooth transition to occupation is emphasised here.

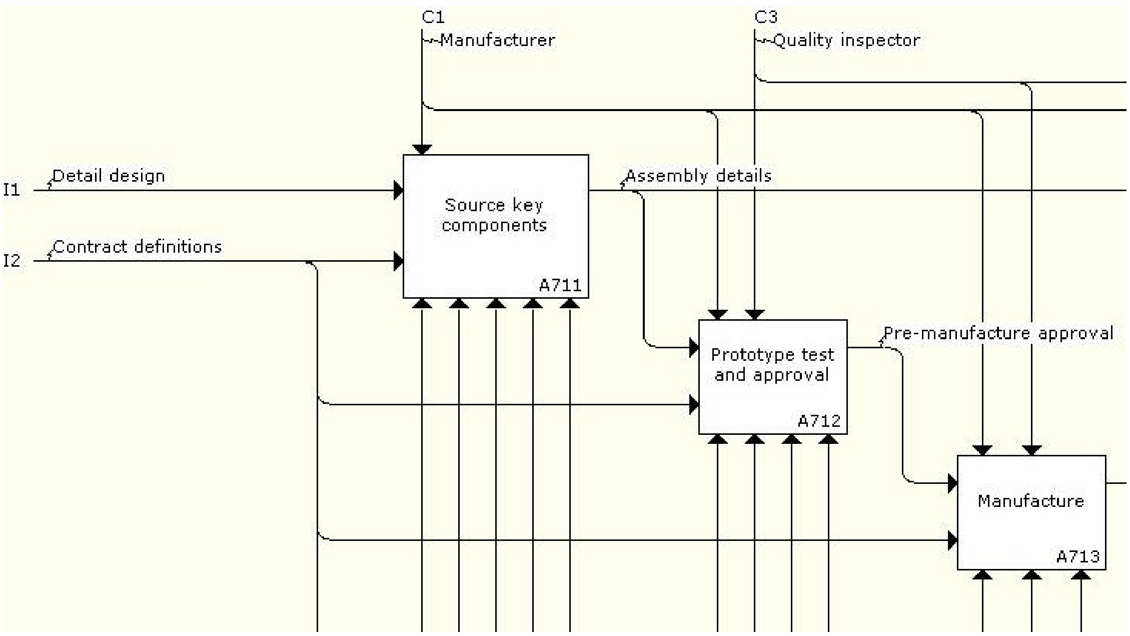

Fig. 5: Off-site fabrication is a key activity

Stage 8: **Facility management** completes the process and provides the basis for a new phase in which the actual demands placed on the building by the client and users can be converted into plans for changes to the building. This stage links directly back to project initiation. Successful development of the design in an electronic form will enable live CAD models to be transferred to the managers of the building or facility without the need for paper drawings. The facilities management brief has the potential to ensure that successful management of the facility is more by design than chance.

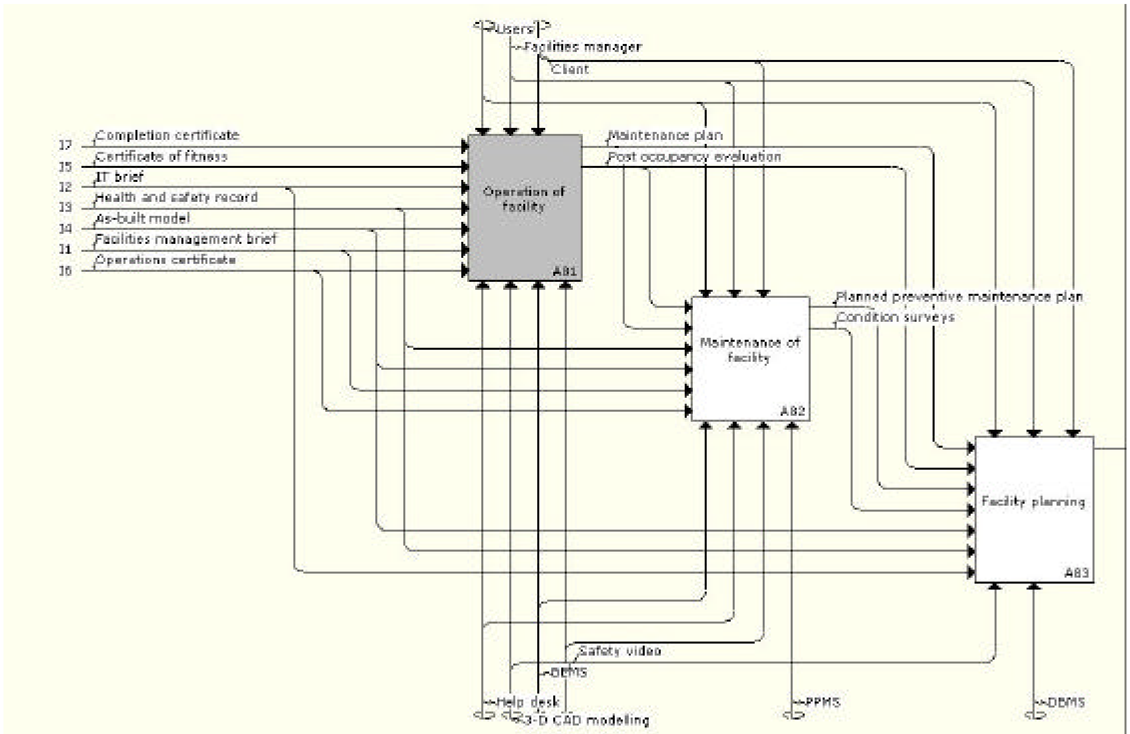

Fig. 6: Retaining the design model of the building to support FM

3 The next steps

Each of the projects has been analysed and presented using a functional modelling tool. The tool has been used to compile a generic process model. This same tool can also be used to capture process time and costs for activities, resources and products.

The initial benefits of using the tool are in organising, modelling and analysing projects As-Is functions and their dependencies to produce a To-Be view of the process. In the next phase of the research, the tool will be used to:

- identify value adding functionality, that is both essential and non-essential non-value added functions;
- track and analyse the cost of the project's activities with automated activity based costing;
- model the project's To-Be functions and their dependencies, from which new strategies for performing those functions can be implemented.

The expectation is that different project scenarios can be modelled and costed so that an optimal value pathway can be found through a project.

4 Conclusions

The research, reflected in this paper, is a partial account of attempts at re-engineering the design and construction process in order to bring about added value. It is largely empirically based and draws out best practice elements from real projects, which have then been incorporated in a new generic model for construction. Armed with base information as to how real projects perform, research effort will now concentrate on refining the process through feedback from new projects using cost and time data. In this respect, IT will be sure to play an increasing role.

5 References

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