A SYSTEMATIC APPROACH TO DEFINE CLIENT EXPECTATIONS OF TOTAL BUILDING PERFORMANCE DURING THE PRE-DESIGN STAGE

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ABSTRACT

There are both demand-side and supply-side reasons why total building performance is taking a higher profile nowadays. On the demand-side, expectations, standards and requirements of building occupiers have increased owing to advances in technology and changes in economic conditions. Property occupiers and owners have become less tolerant of deficient or unsuitable buildings and increasingly require facilities that will be comfortable to occupy, cost-effective, efficient to run and ensure added value assets.

On the supply-side many existing buildings, through accelerating wear and tear, premature degradation, neglect, inadequate maintenance, or a combination of these factors, are failing to meet those expectations and demands. In search for improvement the need for defining the client's expectations of total building performance is recognised.

Depending on the type of client (end-users, owners, tenants) the expectations of performance can vary in line with the difference in interests. This paper examines these expectations of whole building performance with the focus on the end-user. In doing so the client's interests are highlighted in terms of functional requirements on fitness for purpose, quality and flexibility of the workplace over time, healthy and productive indoor-environments, and added value of the facility for the business process. Consequently, conclusions and recommendations are provided in the field of procurement and in methods for the measurement and assessment of the expected performance.

The approach aims at the facilitation of sound communication about total building performance with clients in the pre-design stage and provides an assessment-method of these performances during all stages of the building process. By adopting this approach should rise client satisfaction with (and recognition of) the initial performances at the moment of delivery and during the period of intended use.

The systematic approach is characterised by treating the client's expectations of performance and methods of its measurement separately in the domains of demand (project initiation and definition), production (design and construction) and supply (use and facility-management). This paper also describes the assessment of total building performance by recognising a significant interrelation between a desired user-pattern and strategic concept-related functional requirements and how to maintain this recognition during the building process. Finally the problem of matching functional requirements and technical solutions is treated accordingly. Therefore, the assessment of how well a building is behaving overall and in the long term should be seen holistically.

KEYWORDS

Client expectations of performance; end-user and workplace quality; whole building performance; holistic approach; performance based building assessment.

INTRODUCTION

In line with high-level requirements dissatisfaction is growing among consumers with design and construction, because building projects are widely seen as unpredictable in terms of delivery on time, within budget and to the standards of quality expected. Property occupiers and owners require facilities that will be comfortable to occupy, cost-effective and efficient to run, while ensuring added value assets.

An important indication for this failing cause is the current tendency in the building branch, characterized by a low and unreliable rate of profitability, by poor ability to keep abreast of innovation in processes and technology, by lack of proper career structures to develop supervisory and management grades, and finally (as a consequence) by too many clients still equating price (Egan 1998). This tendency is widely seen as one of the greatest barriers to innovation, and in search for improvement we decided to zoom in on aspects that are both fundamental and practical to handle. Therefore, the suggested approach is developed relatively independent from this tendency and instead it focuses at the development of process-tools as to facilitate and enhance sound communication, interaction and process control.

The approach is based on the assumption that, in client expectations of the total building performance, the workplace-quality is starting to become identified as a key to business competitiveness.

CLIENT EXPECTATION OF PERFORMANCE

Client expectations and (total) building performance are independent to each other and kind of fuzzy in themselves, so when treating of this subject one shall recognise the potential misunderstandings and even frictions between the two (CIB-W60 1999, Takeda).

Depending on the type of client (end-user, owner, property-manager, developer, general-contractor etc.) the expectation of performance can differ due to the difference in interest.
Each client group has completely different, and at times contradictory, expectations and needs of a building and building spaces and elements (CIB-W60 1999, Cooney).

Rather than the term of performance the issue of non-performance can be recognised and defined in a similar way for all stakeholders. When considering the prevention of non-performance, i.e. failure, this can be defined for all stakeholders as being a state or condition or performance which is recognised by both an ordinary building user and by a person knowledgeable in the appropriate building sciences as being a failure. That definition at least partly overcomes the problem that different people have different expectations of building performance according to what they have been accustomed to. Along with performance one must also consider durability which is a measure of how long the satisfactory performance can be expected to last, on the different levels of materials, components and the building as a whole (CIB-W60 1999, Porteous).

FOCUS ON END-USER

In search for improvement it is suggested to carry out research from the focus of the end-users regarding this total building performance, their health, comfort and productivity result. In this context, one should be aware that the building itself costs only a few percent of the total costs per work station. Most of the costs are wages or wage-related. For the client the building is a business asset, next to other business assets such as capital, staff, technology and information. An example from the Norwegian practice shows that an estimated 2 min/day rise in productivity (minimum) equals a US

$400 annual saving per person, while the extra costs per person due to a better IEQ was only US $178 (CIB-W60 1999, Flatheim).

When focusing at the end-user we might track 3 stakeholders (CIB-W60 1999, Howard):

- The owner/financer, who looks at the building(s) as a real estate market asset,
- The real estate manager/repairer, who looks at the building(s) as a financial asset of the corporation,
- The occupant/client as an enterprise, who looks at the building(s) as an operational asset that serves as a factor of production.

All are stakeholders who have both a direct and identified interest in the facility and its provisions as well as an interrelated business interest. The W55/65 symposium in South Africa 1999 was focused on customer satisfaction ending up in a lot of support for a “stakeholder-view”. But the issue is rather complex and the suggested focus on end-users may well make good sense (CIB-W60 1999, Barrett). In search for sustainable quality a mutual benefit situation should be created that can be recognised by all partners in the process as a profit for each of them. The suggested approach in this paper relies on the assumption that the workplace is starting to become identified as a key to business competitiveness (fig. 1).

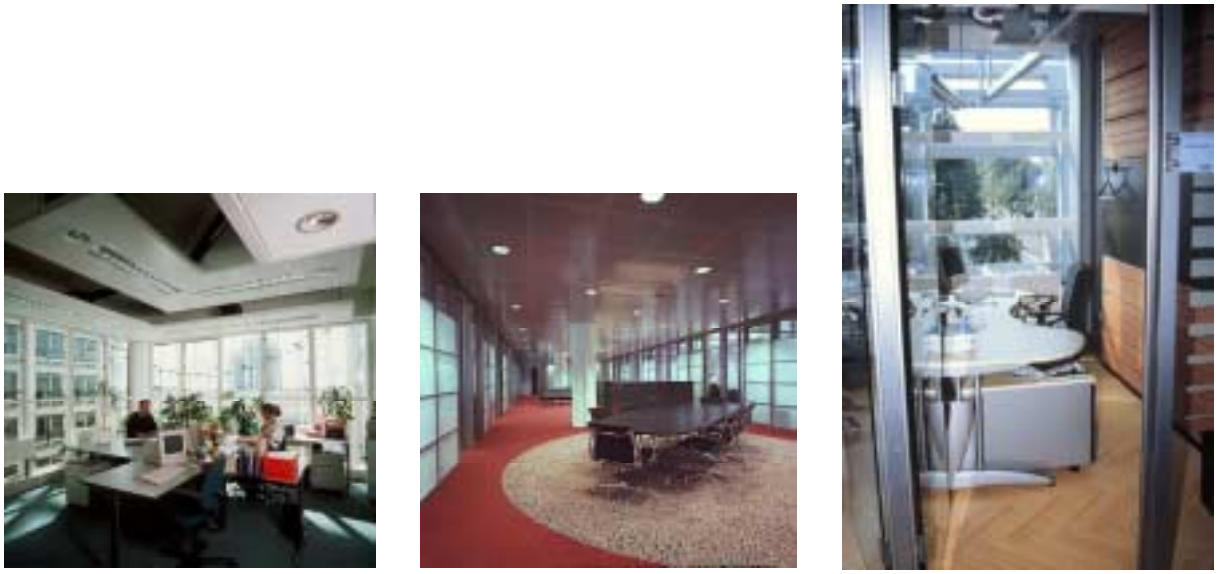

Figure 1. Illustration workplace

In general there are similar expectations of real estate performance when considered from the client as an enterprise. (The term “enterprise” used to include private sector corporations, companies and/or public corporations such as post offices, and government departments and agencies).

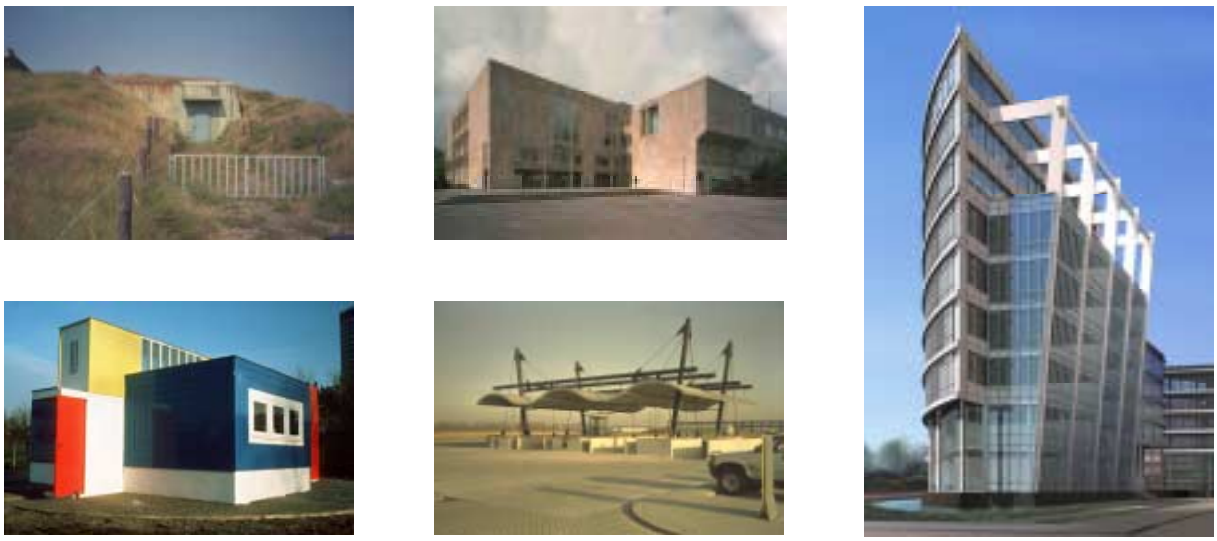

Figure 2. Illustration of corporate enterprise real estate

An enterprise uses facilities to conduct its business; to provide workplaces for its staff, to provide places to meet customers, to manufacture its products, and for a range of other business purposes (Davis et al. 2000). The primary measures of value is its functionality on the level of the workplace (does it meet the physical, ergonomic and organisational requirements?), its serviceability on the level of the total building (does it facilitate and create added value for the business process?), and eventually its corporate image such as special architectural effects, representativeness, exemplarity etc. on the level of the object on site (fig. 2).

THE SYSTEMATIC APPROACH

The proposed approach is based upon research on the fields of functional requirements, communication and information management during the process from project definition to use and facility management. The main issue is to deliver the desired total building performance rather than to describe or prescribe how to achieve this. Therefore the focus on outcome-performances is suitable when selecting the proper approach. An important and a critical success factor is the integral approach from the very first steps in the phase of project initiation and definition and throughout the design and construction process. Central to this view may be that argument that there is a need to scope a design agenda (Ang/Wyatt 1998, ”The role of performance specifications in the design agenda”).

A systematic three-steps approach may in effect be defined by means of:

- distinguishing three separate domains with specific characteristics in process control when it comes to client expectations of total building performance, i.e the domain of demand (project initiation and definition, i.e. the pre-design stage), the domain of production (design and construction phases), and the domain of use and facility management (delivery and maintenance).
- recognising and analysing these different and specific characteristics as to develop tools for process control accordingly.
- indicating how to link the 3 domains when it comes to assess the expected initial performances throughout the process.
- indicating how to involve the client during the process prior to and after procurement without altering liabilities as to bridge the gaps in the methods of measurement of total building performance.
- indicating how to establish sound information management during the process.

Such an approach includes “the art of designing” a performance based brief, accompanied by preliminary sketches and 3D models/prototypes, that frames properties which can provide assessment tools during the process of production and use (design and construction, delivery and facility management). In this process a professional architect should be consulted as to ensure the comprehensive result of the approach.

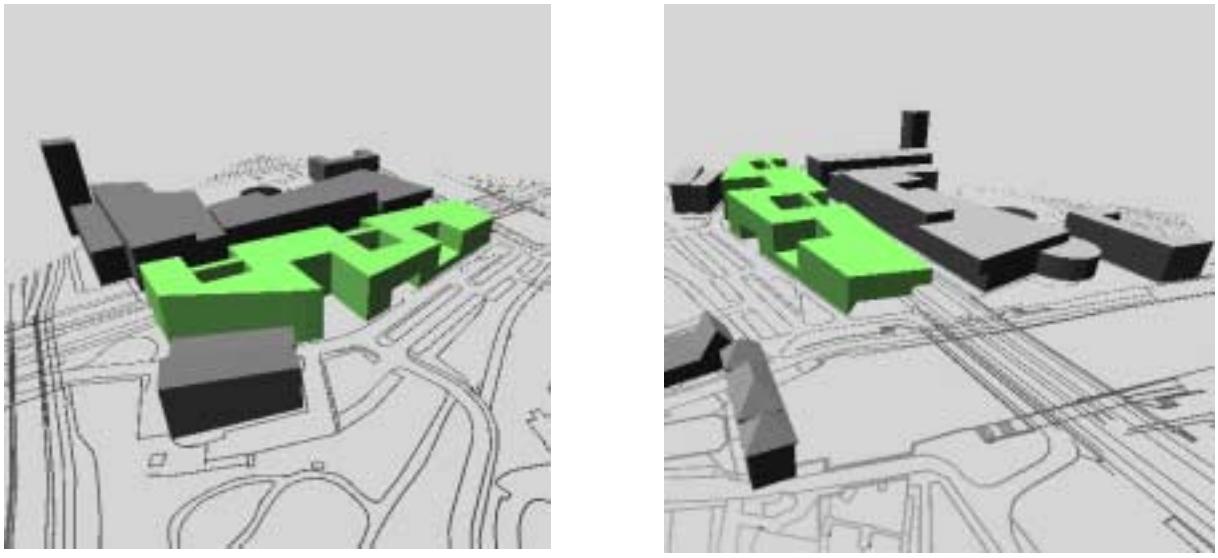

Figure 3. Illustration of 3D model for feasibility studies on site

A major problem is how to link the qualitative statements (derived from the client expectations of performance) and the quantitative criteria used to assess a proposed performance-based design.

In this proposed approach the three main domains (fig. 4) for demand, supply and assessment are distinguished in the process as to get hold of the demand-supply matching problem:

- The domain of demand: project initiation and definition, i.e. the brief and pre-design. This is where the client’s initial expectations for performance are to be defined in a performance-based brief, linked to a design-concept that stands for both qualitative and quantitative aspects as to allow the first assessment of the client’s expectations. This domain ends up in the procurement system and type of contract for design, construction and, eventually maintenance, after care etc.
- The domain of production: i.e. the project design and construction. This is where the brief and the design concept (as a result of the first assessment) are processed into a design & construct procurement procedure that allows the next sequential steps of assessment of the client’s expectations of performance, i.e steps that go with the relevant stages of the production process. This domain ends up in the delivery of the constructed facility.
- The domain of use and facility management: i.e the delivery, use, service, maintenance and after-care. This is where the client’s expectations of performance (as a result of assessed production) are to be met by their initial expectation of performance, eventually enforced by adequate services and after-care.

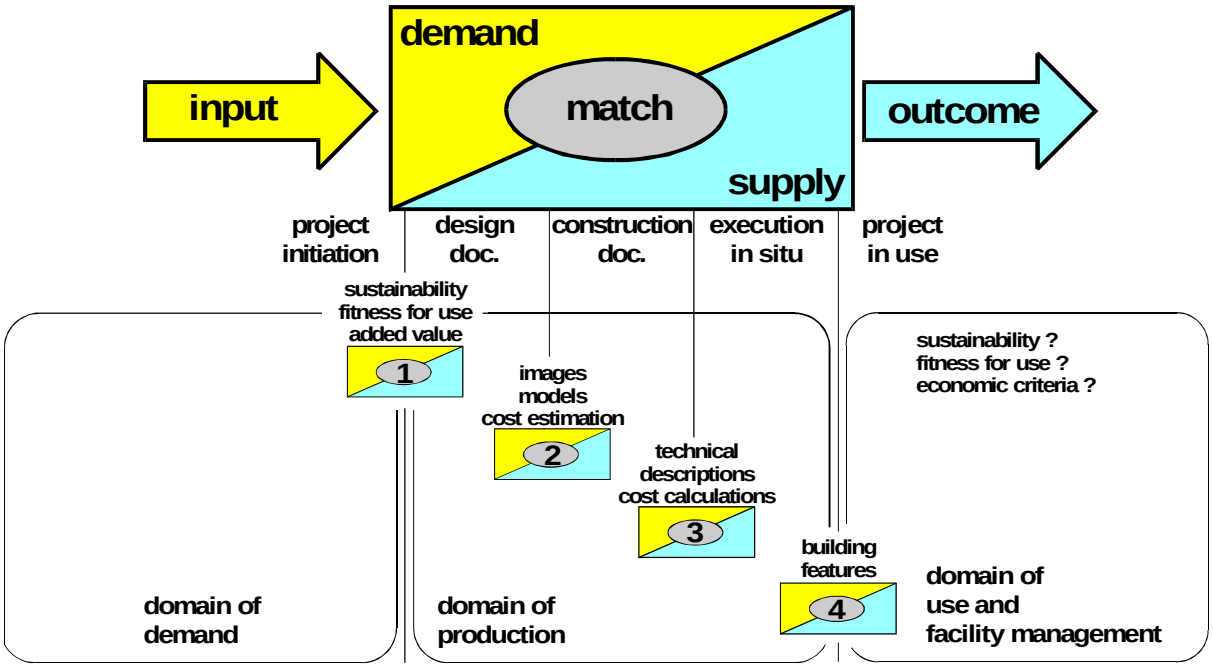

Figure 4. Input-match-outcome related to the 3 domains

THE DOMAIN OF DEMAND

This domain of demand covers the client expectations of (whole) building performance during project initiation and definition**.** In this early pre-design stage, ranging from pre-briefing to project-definition, it comes down to properly defining goals and objectives in terms of, for instance, the required added value of the facility to the client's business process, the flexibility and quality of the workplace etc., and to express these in functional statements and, where possible, performance requirements. Communication should be focused on functional requirements and on agreement about these in a suitable performance-based framework that allows explicit assessment during the entire process. To assess how well a building shall behave overall and in the long term a more holistic approach is needed (Douglas 1996). For this purpose a holistic model is developed that provides an oversight of functions and requirements for use (the content of an integral client's brief), related to decision making in the phases throughout the process and referring to the different knowledge domains involved (fig. 5).

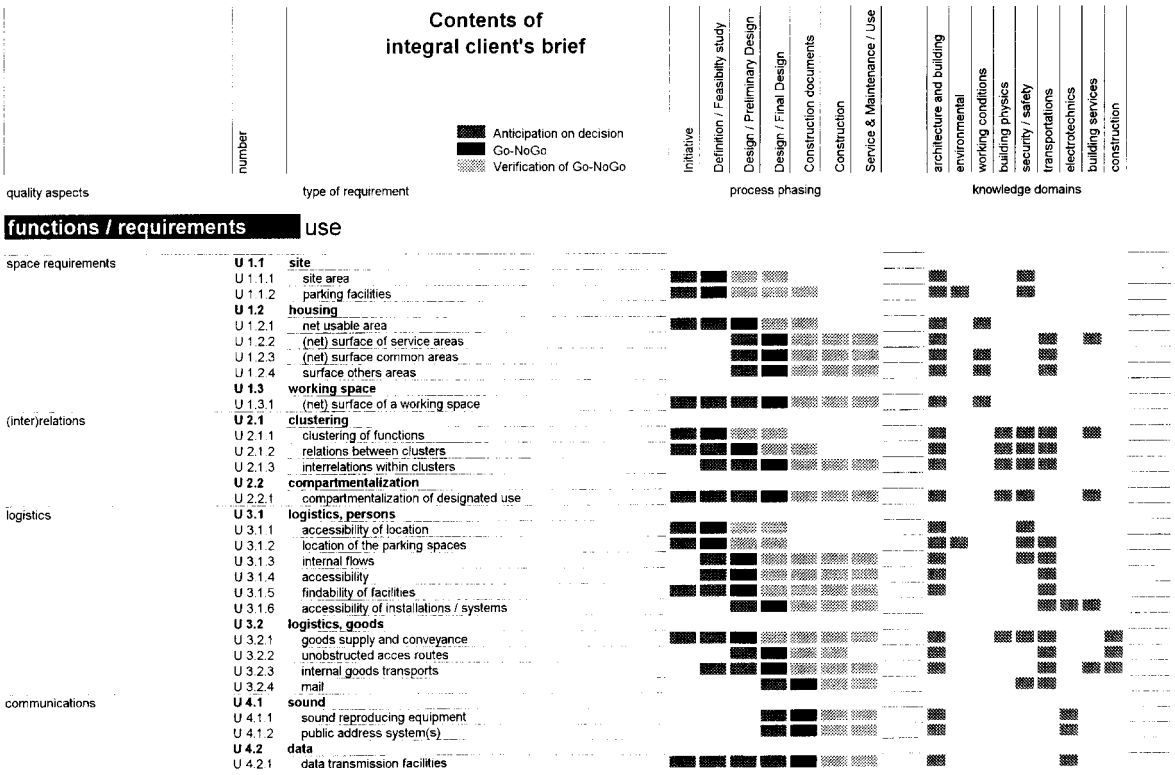

Figure 5. Holistic model

This total building performance is expressed in a set of (performance-based) requirements that define what will be suitable for a particular use or function to what budget, within what time-frame and including which set of warranties and after-care services.

The suggested approach in this domain should be seen holistically through “process-steps”:

- Determine the profile of required levels of total building performance in terms of serviceability, functional requirements, budget and timeframe. Use the ASTM standards on whole building functionality and serviceability (Davis et al. 2000).
- Determine a procedure for properly procuring and assessing this profile, determine what and how to measure by client involvement those performance aspects, that cannot be covered by existing methods of measurement.
- Create conditions to allow client involvement, suitable for this purpose, during the process of production as to bridge the gaps in the existing methods of measurement when assessing total building performance (Ang 1997).
- Create an insight in contract types that may be suitable for the purpose (W92 Procurement Systems) add these conditions of client involvement and select a design & construction (eventually extended with maintenance) contract type for this project.
- Complete project definition, start the procurement procedure, select the tenderer and agree about the conditions of client involvement during production, delivery and after-care, etc.

THE DOMAIN OF PRODUCTION

This domain regards the project’s design and construction and can roughly be characterised by a black-box-matching mechanism between the client’s (performance-based) brief and the supply in building features, that should represent the desired total building performance. In fact it is far from simple to keep the initial performances (expressed in functional requirements) on track in this domain and there is a large risk for a mismatch at the moment of delivery, because building features as

supply-outcome can not be described in advance when defining the project, not even when designing a performance based brief.

One reason for failing causes is that the quality-control of built facilities traditionally relies on an explicite assessment of the technical quality of building components, parts and materials (which does not directly affect the client expectations of performance) while on the other hand quality of the building design (which indeed does directly affects the expected physical, ergonomic, organisational and economical performance of the total building) is assessed implicitly beyond proper control. As a consequence a considerable amount of client dissatisfaction can arise despite explicit quality control because many reasons for underperformance relate to the total building performance rather than to the components and materials (Ang/Wyatt 1998).

A significant problem is, however, recognised because the measurement of total building performance is far more difficult than the measurement of the performances on the level of components and materials and because there is a lack of methods.

Moreover this black-box process does in fact consist of sub-processes of demand/supply matching mechanisms, each characterised by a different way of expressing and assessing quality and as such creating significant moments of risk (fig. 6):

- Match 1 is between the performance-based brief and the images, sketches, drawings, 3D models and cost estimations of the design as to allow assessment.
- Match 2 is between the assessed design and the technical descriptions, drawings, cost calculations that go with the construction documents as to allow assessment.
- Match 3 is between the assessed construction documents and the materials, load bearing structures, applied hvac systems etc. as to allow assessment during construction in situ.
- Match 4 is between the raised total building and the initial performance-based brief, budget, delivery time, eventually maintenance and after care included.

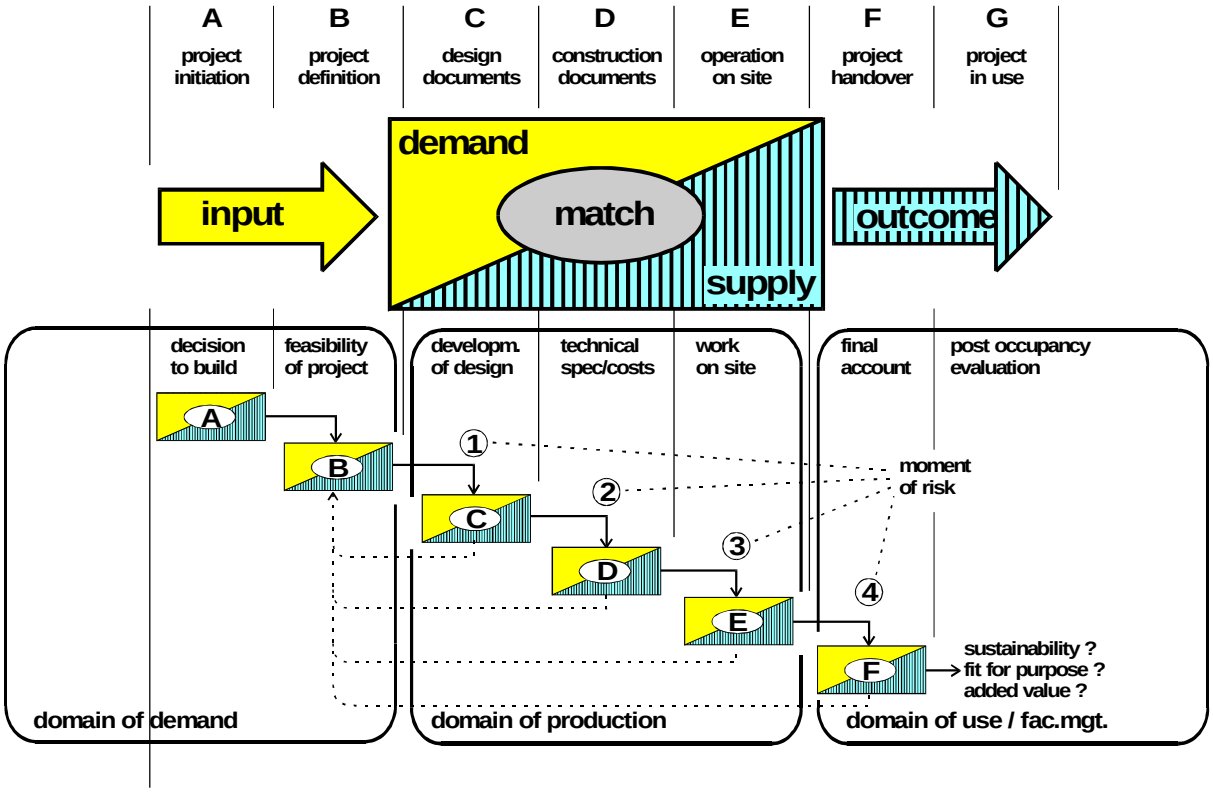

Figure 6. Design & build domain, moments of risk

Each match is characterised by a different way of expressing (total) building quality, and in the traditional design and construction process it is definitely difficult to make sure that the constructed result matches the total building performance that was initially required.

Actually the client/end-user should not be bothered by the complexity of these matching risks, but as to ensure client satisfaction we should allow him/her to "take a look in the black box", without mixing up liabilities. This is where legal aspects need reviewing (W92 Procurement Systems) when the agreement includes a fixed budget and a performance-based total quality outcome within a fixed timeframe that the tenderer is committed to deliver.

THE DOMAIN OF USE AND FACILITY MANAGEMENT

In this domain it comes down to assessing the results of performance auditing and process control in the previous stages. In simple terms "building performance" has been defined as behaviour of a product in use (Douglas 1996). On the one hand it demands for a procedure of delivery and acceptance whereas the agreed initial performances are to be recognised, on the other hand it is a matter of warranties and after care services as to guarantee the aspects of total building performance over time that were agreed prior to procurement. Actually this domain is where the added value of the facility to the client's business process can be audited properly, both in qualitative and in quantitative terms. As such the expertise derived from post occupancy evaluations can be considered to be a major success factor to research on the fields of performance-based building.

COMMUNICATION, INTERACTION AND INFORMATION MANAGEMENT

The success factor of the suggested approach is in making the right communication and interaction happen, provided all parties in the process are convinced about gaining benefits by doing so. The approach imposes novel requirements on the flow of information within and into the process. This needs to be supported by sound information management. The CIB-W102 discussion note recognises 3 problem areas in relation to this approach (Davidson 2000):

- Information required in order to proceed from the functional programming step to establishing appropriate performance criteria; design office's experiences and feedback from post-occupancy analyses are sources for this information.
- Information required in order to evaluate the performance characteristics of a design in the course of it being developed; referring to general information about the performance characteristics of broad categories of materials and products used in combination.
- Information required in order to specify materials and products in performance terms; referring to information collected from providing manufacturers.

Within the process of managing communication and interaction there are 2 fundamentals popping up with regard to the suggested approach:

- There should be enough reason for the decision-makers in the process to change the ways they access information while working with the total building performance approach.
- The need for information integration about performance criteria or performance characteristics as well as the need to disseminate guidance to those who prepare integrated performance information and those who use it.

CONCLUSIONS AND RECOMMENDATIONS

Within the theme of client expectations of (whole building) performance, in particular the mechanisms of matching demand and supply, appear as different phenomena in the distinct domains of demand, production and use and facility management. Throughout the process the intended building quality (expected performances) is continuously transformed and interpreted differently in each phase. In consequence, the difficulties and problems of keeping the initial building performance

on track can not be solved by traditionally performance auditing on the level of technical solutions only.

Therefore an improved holistic approach should be developed to allow decision-making on the right issues in the right phase with the right expertise. In such an approach the impact of goals and objectives, functional requirements, performance requirements, acceptable technical solutions and verification can be recognised and enhanced properly in both the different phases of the process and the different domains of knowledge represented by the participants in the process.

REFERENCES

Ang, G.K.I. and Hermans, M. 1999 “Serviceability of Buildings”, CIB W60 workshop at 8DBMC Conference, Vancouver 1999, CIB Home page and bulletin July-August 1999.

Ang, G.K.I. and Wyatt, D.P. 1998 “The Role of Performance Specifications in the Design Agenda”, The International Journal of Architectural Management, no 14 ISSN 1026-3454.

Ang, G.K.I. 1997 “The Role of Performance Control in Project Initiation” CIB-ASTM-ISO-RILEM 3rd Symposium proceedings vol.2, ISBN 965-222-753-6.

Ang, G.K.I. 1995 “Performance Tendering, A Threat for the Architect?”, The International Journal for Architectural Management vol. 10.

Bröchner, J., Fredriksson, G. and Ang, G.K.I. 1999 “Sustainable Development and the Performance Concept”, Building Research and Information vol.27, no 6, ISSN 0961-3218.

Egan, J. 1998 “Rethinking Construction”, www.construction.detr.gov.uk/cis/rethink/1.htm.

Douglas, J. 1996 “Building performance and its relevance to facilities management”, Facilities volume 14 nrs. 3&4 ISSN 0263-2772.

CIB-W60 Preparation Draft 26 Oct. 1999 “Client expectations of peformance, and methods of its measurements”, CIB World Congress 2001 - W60 file.

Davis, G. and Szigeti, F. 2000 “ASTM Standards on whole building functionality and serviceability”, ISBN 0-8031-2734-0.

Davidson, C. March 6, 2000 “Discussion Note CIB W102 Information and Knowledge Management”.