Clients' activities at the design front-end

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Abstract: This paper describes a study analysing the front-end of the design process for primary healthcare facilities in the UK. A case study approach was used to gain a detailed understanding of the clients' activities at the front-end of the design process. The research identified the process undertaken to define new requirements, the difficulties faced by the various parties involved and the impact these had at the front-end. The findings have implications for managing requirements with novice construction clients.

Keywords: built environment for healthcare, front-end design activity, requirements capture

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The management of the design process has been a topic of study for over 40 years. There have been successive theories postulated with regards to effectively managing the process (see, for instance, Oakley, 1990; Cross, 1994; Gorb, 1994; Cooper and Press, 1995; Mozota, 2003). The relationships between the client and the designer and the effectiveness of briefing have been identified within such theories as one of the main contributing factors for good design (Cooper and Jones, 1995; Barrett and Stanley, 1999). Furthermore, it is recognised that at least 80% of the costs is determined at the front-end of the process, at the briefing and design stage (Bruce and Cooper, 2000). This is especially the case in construction (CRISP, 2001).

There is currently a large programme of public building underway for the primary healthcare sector in the UK (DoH, 1998). The ethos of this programme is to deliver health and social care jointly so that people can have better, easier access to services through buildings which should also help regenerate deprived urban areas. It is recognised that the design of primary healthcare buildings is essential for the improvement of the services delivered to the community (Gesler et al., 2004). This has created an opportunity to take a fresh approach to the buildings that house healthcare provision, as well as an opportunity to consider the impact that the physical environment has on patients and on healthcare staff.

Primary Care Trusts are now responsible for redesigning primary healthcare services and are 'the clients' of the new facilities being produced. As such, they are responsible for a number of activities, including identifying stakeholders, capturing requirements and briefing designers. However, Primary Care Trusts are newly formed organisations, and have no previous experience or skills in design and construction. They therefore provide an opportunity to examine the process of establishing requirements and briefing in a new context by inexperienced people working within new organisational structures. We use the terms 'novice/inexperienced client' to define this scenario.

The main objective of this research is to better understand how novice construction clients actually develop design requirements at the front-end and how the circumstances in which they operate influence the final product and the design process. Four research questions are addressed:

1. How are requirements developed at the front-end?
2. What do novice clients do at the design front-end in order to brief?
3. What are the difficulties faced by novice clients?
4. How such difficulties affect requirements definition and management?

Initially this paper discusses the identity of construction clients. The paper then synthesises the design front-end activities and problems as described in the literature. This is followed by an examination of the specific clients' activities in the process. Thereafter, the methodology adopted in this research is presented. Case study findings are then described, and finally implications for requirements management are discussed.

1. The identity of the construction clients

Different conceptual approaches have been adopted to understand the characteristics of the construction client over the last years in the UK. Early views generally assumed that the term 'client' implies a person or a well defined group of people which act as a single entity (Newcombe, 2003; Bertelsen and Emmitt, 2005). For instance, clients were defined as *the person or firm responsible for commissioning and paying for the design and construction of a facility* (BPF, 1983). However, issues such as the separation of ownership and occupation and the rise of the corporate client have led to confusion about the clients' identity and their interaction with the industry (Newcombe, 2003).

Past research has identified different types of clients aiming to increase clarity on this issue (Green, 1996). Higgin and Jessop (1965), for instance, distinguished between *sophisticated* and *naïve* clients on the basis of their previous experience with construction. Masterman and Gameson (1994) however, argued that clients cannot be classified solely on the grounds that they posses previous experience; they must have experience of the particular building type in question.

In the New Product development area, Darlington and Culley (2004) described two customer types which can also be used to characterise the construction client. The first type, the identifiable customer, represents the individual who has a specific design problem, e.g. a family needing a new house. The individual has a clear view of the problem and the context in which it occurs, which can be discussed directly with designers. By contrast, the 'virtual' customer represents a group or class of individuals. The actual design requirement process is quite different for each type of client. Most design methodologies consider requirements capture for the 'virtual' customer, e.g. Ulrich and Eppinger, (2000) and Cross (2000). Considering such characterisation, it is possible to state that the BPF (1983) definition of the client may be appropriate for the 'identifiable' customer, but it does not consider the multifaceted nature and complexity of the 'virtual' customer.

In summary, there are different approaches to describe the construction client's identity, some focus on the level of experience the client has with construction and others on the level of complexity of the client (organisation). Public sector organisations like the NHS may be classified as a virtual, complex client, as it needs to appropriately represent various stakeholder groups as well as wider society needs. In the primary healthcare context, Primary Care Trusts (PCTs) are newly established organisations operating against a background of change in primary care, whose employees have little or no experience with design and construction. Therefore, they can be considered the 'naïve', or novice clients. The challenge for virtual, novice and complex clients is, therefore, to provide appropriate information for design and construction even though they have poor understanding of the process. The next section describes the design front-end process, and more specifically the activities clients are expected to develop throughout the front-end.

2. Design front-end activities

The preliminary stages of a project have been labelled ‘fuzzy front-end of the new product development process’ by Smith and Reinertsen (1991) and this term has been since adopted by several authors (e.g. Cooper, 2001; Zhang and Doll, 2001; Khurana and Rosenthal, 2002).

The need for understanding the design front-end has been closely associated with its importance for project success. It has been widely acknowledged in both manufacturing and construction literature that the front-end is critical, and benefits resulting from improvements in the front-end are likely to exceed those that result from improving subsequent design stages (Cooper and Kleischmidt, 1995; CRISP, 2001). However, the front-end is often lengthy and little is understood about its nature in the context of the overall process (Reinerstein, 1999; Van Aken and Nagel, 2004).

Reinerstein (1999) and Zhang and Doll (2001) suggest that front-end activities are the final gate before the team decides to invest in designing and building products. Khurana and Rosenthal (2002) described it as the cross-functional strategic, conceptual and planning activities that typically precede detailed design and development. They also explain that at the front-end new product ideas gain shape, plans and support leading to their approval and execution. In this paper, we adopt the term ‘front-end’ with reference to the preliminary, pre-project stages of the design and construction process, and requirements management is an on-going activity throughout this process.

In the New Product Development literature front-end activities have been organised under pre-phase zero (opportunity identification and idea generation), phase zero (product concept and definition, including market and technology assessment) and phase one (product definition, justification and planning) (Cooper 1994; Zhang and Doll, 2001; Khurana and Rosenthal, 2002; Van Aken and Nagel, 2004). In the construction literature, the initial phases of the design and construction process present parallels with the process outlined above. The design and construction process protocol (Kagioglou et al., 1998) establishes the process front-end as:

- phase 0 (demonstrating the need for the project), including the outline business case
- phase 1 (conception of need), including the brief
- phase 2 (outline feasibility), including feasibility studies for different design options, and
- phase 3 (substantive feasibility study), which is the building product definition, and includes the conceptual project brief

The literature stresses that front-end success depends on the existence of foundation elements, i.e. a clear product strategy and a product development organisation (Khurana and Rosenthal, 2002). Product strategy elements include the formulation and communication of a strategic vision for the product, as well as its high-level requirements. The product development organisation should clearly define structure, stakeholders, communication networks, roles and norms. In construction, foundation elements heavily depend upon clients, i.e. the product strategy will be defined by clients

and the project organisation will be greatly determined by the procurement/contractual arrangements selected by clients.

The overall product strategy is further defined and refined at the front-end through requirements capture, defined as: *'…the iterative process by which the needs, preferences and requirements of individuals and groups – stakeholders – significant to product development are researched and identified'* (Bruce and Cooper, 2000:xii). Its objective is to create a consistent set of information that represents the composite views of all stakeholders, from which value can be generated through design.

In construction, building requirements are described in the brief. Early approaches considered the brief as a static document produced at a specific point in time (e.g. RIBA, 1970). However, theoretical developments and empirical research led to the recognition that requirements capture is in reality an ongoing process which evolves throughout design (Luck et al., 2001). Furthermore, challenges to achieve an agreed composite view of all stakeholders were realised, as in many instances stakeholders needs and interests are conflicting (Green, 1996; Darlington and Culley, 2004).

In summary, the clients' involvement at the front-end is essential in terms of determining the project organisation and supporting the appropriate definition of business and user needs, i.e. defining requirements and providing stakeholders with enough information to allow the generation of ideas, their development and assessment. However, construction clients can have varying levels of involvement and may or may not play an active role in the process (Barrett and Stanley, 1999). The next section synthesises clients' activities as proposed in the literature.

2.1. Clients' activities at the front-end

Past research identified that clients can have difficulties in providing timely and appropriate information for design (e.g. Barrett and Stanley, 1999; Darlington and Culley, 2004). The difficulties faced by clients are also recognised by the industry. Many professional reports are dedicated to provide guidance to clients, e.g. CABE (2003), NHS Estates Best Client Guide (NHS Estates, 2002), and reports from the Construction Clients Group (see http://www.constructingexcellence.org.uk/resourcecentre/clientzone/processmap.jsp) and the Strategic Forum's accelerating change (2002).

Nevertheless, academic recommendations from both manufacturing and construction appear to be somewhat prescriptive and assume a level of client knowledge which would enable them to perform appropriately. This assumption becomes clear when analysing descriptions of the clients' activities put forward by the literature. Table 1 presents a summary of the activities clients should undertake to achieve successful building outcomes. These were here organised under ten generic themes. The table also describes difficulties that novice or inexperienced construction clients might face when dealing with such activities.

TABLE 1 HERE

Clients need to understand the construction process phases, its timescales, and the type of input they need to provide for professionals before getting involved in a project (Barrett and Stanley, 1999). Signing-off of the process at different stages is important as clients carefully think about what they are agreeing to, and should understand the effects of later changes (Shein et al., 2004).

A number of studies suggest that successful design requires constant client input, including users' preferences, the identification of important features as the product concept is defined and the definition of measures of the importance of needs against which to evaluate design proposals (Smith and Reinertsen, 1998; Kamara et al., 2000; Bruce and Cooper, 2000; Darlington and Culley, 2004).

CABE (2003) recommends that clients need to appoint an in-house project team empowered to make decisions on behalf of the client organisation. Such teams should coordinate the project and ensure deadlines are met (Blyth and Worthington 2001). However, as suggested previously, the interests of the different organisations and groups involved in a project often conflict (Cherns and Bryant, 1984; Green, 1996; Luck et al., 2001). For instance, Lawson (2002) showed that patient representatives and senior managers highly valued the therapeutic value of architecture, while the directors of NHS estates, who actually briefed hospital designers, where more interested in new methods of procurement, and showed little interest in the contribution of the new building to the NHS performance. Therefore, as suggested by Newcombe (2003), it is often complex to facilitate the level of trade-offs required between different stakeholders stake in the project and their multiple objectives.

Such difficulties also influence user participation, which is also essential for project success. Lipman and Harris (1998) observed that user participation is linked with the empowerment, or stake, of those whose views are sought. Therefore, prioritising requirements, ensuring that the assumptions made are valid, realistic and achievable and reaching consensus on the most important requirements can be challenging. Barrett and Stanley (1999) and Luck et al. (2001) further recommend that user involvement should be assessed relative to each situation, as sometimes the number of users can be large, and therefore difficult to manage.

In some cases a new building will be needed to host new or redesigned business operations (CABE, 2003; Trebilcock, 2004). Several studies (Bruce and Cooper, 2000; Blyth and Worthington 2001; Darlington and Culley, 2004) point out that clients need to appropriately describe both existing and new operations. Also, the building vision should be clearly established, including the definition of the project objectives, priorities and risks involved. Kamara et al. (2000) further suggests that these should emerge through a bargaining process between the key stakeholders. Communicating this information to the design team in a significant way to ensure requirements are appropriately taken into account is essential (Smith et al., 1998).

However, there are communication gaps between users, clients, owners and designers (Barrett and Stanley, 1999; LEAF, 2001; Kaya, 2004). Sometimes communication is made difficult by the absence of a common language and, as a consequence, designers are criticised by their failure to understand the business needs of clients (Green et al.,

2004). Clients and users may also have difficulties in expressing their needs, especially in terms of intangible requirements (Cooper and Press, 1995) and this may hinder an appropriate definition of requirements.

The descriptions of clients' activities provided in Table 1 are by no means extensive. However, novice clients may not be aware they need to develop such activities, or may not know how to best perform them. In this context, the objective of this research is to better understand how novice construction clients actually conduct their activities in practice, focusing on requirements at the front-end. The research also aimed at identifying how the circumstances in which novice clients operate influences this process.

3. Research method

The design front-end is complex and very much shaped by the context in which it takes place, as well as by the perspectives, beliefs and motivations of the individuals involved. Thus, the research method applied should be appropriate to help understanding complexities within context specific settings. Therefore, the epistemological option for this research was based on the interpretative school of thought. Interpretivism is concerned with observation and description, expressing layers of meaning (Silverman, 1998). Thus, qualitative approaches were used to inductively, deductively and holistically understand human experience (Easterby-Smith et al., 2002). The researchers analysed the design front-end with an emphasis on the facts, words and meanings to reach a broader understanding of the clients' activities and problems faced throughout the design front-end. According to Lawson et al. (2003), it is important to gather empirical evidence to better explain and predict the design process. In such way, research can become more effective in providing support for improvements in practice.

The research approach adopted is case study in a diagnostic action research mode (Susman and Evered, 1978). The use of case study was appropriate as it provides grounds for investigating the front-end in its real-life context. The primary unit of analysis for this study is the local LIFT (Local Improvement Finance Trust-see section 4.1), therefore information about the programme as well as the four first tranche of primary healthcare schemes (4 projects) developed have been analysed as a single case. The case was selected due to the fact that the Primary Care Trusts are novice construction clients directly responsible for defining building requirements. The understanding achieved through the research could be applied by the client organisation to inform the development of future tranches of schemes and it can also inform other LIFT schemes throughout the UK.

Multiple sources of evidence were used to allow for triangulation of data. Data was collected through semi-structured interviews, informal meetings and documentary evidence. A total of 22 two to three hour semi-structured interviews with key personnel from different stakeholder groups involved in the projects were conducted. All interviews were audio-taped, and immediately after each interview the researchers filled in an interview summary pro-forma (Miles and Huberman, 1999), which followed the

format of the interview protocol, including the following information on target questions:

- Interviewee's background (to identify skills and competences)
- Story of the project (to identify the organisational structure in which schemes were developed, front-end activities and the interviewee's involvement)
- Accuracy of the requirements (as perceived by the interviewee)
- Issues/barriers identified
- Possible improvement strategies

When multiple investigators are involved in one research project, it is essential that constant interactive discussion about issues such as methodological perspectives, data collection techniques and analytical processes take place to ensure rigour (Yin, 1994). In this research, the development of a case study protocol and the interview summary forms completed by each researcher were vital tools in assisting such discussions.

Data analysis was done by combining qualitative responses and documentary evidence into narratives describing the front-end process in its context. By tracing the process from the perspective of different stakeholders interviewed, a 'story' was constructed (Eisenhardt, 1991). The story was developed by combining the accounts of the interviewees into a chronological timeline beginning with the decision to set up LIFT and finalising with the financial close of the 4 projects analysed. The stories where then used to identify where the stakeholders experienced barriers.

4. Context of the case study

4.1. Procurement context for primary healthcare in the UK

To avoid a fragmented and piecemeal approach to the delivery of primary healthcare facilities and to concentrate it to the areas of greatest need, the British Government established a new procurement method. LIFTs (Local Finance Improvement Trusts) are public private partnerships set up to allow NHS Primary Care Trusts (PCTs) and their local partner organisations to develop primary healthcare facilities. Public Finance Initiative (PFI) was unsuitable for primary healthcare as the value of any individual project was not attractive to the private sector. Through LIFT a number of schemes are clustered and delivered by a single private sector partner, selected through a bidding process. The private sector is responsible for bringing construction skills for the developments and for:

- Designing the facilities, based on requirements established by the PCTs
- Building the facilities
- Financing the capital costs
- Providing facilities management and support services over a 25 year period

The LIFT programme was launched in the UK in 2001 with 6 first wave local LIFT partnerships. This research focuses on the 4 first tranche schemes developed at one of the first wave local LIFT partnership.

4.2. Design context: LIFT vision

LIFT aims to create a client-driven organisation (Whiteley, 1991) in which building value is based on the needs of clients, users and those of the community as a whole. Hence, it has a twofold objective, i.e. provide local health and social care buildings and catalyse the regeneration of deprived urban areas. Health and social care involves a wide range of services, such as local clinics and GPs (General Practitioners) surgeries, opticians, dentistry, pharmacies, along with social services like libraries. The integrated delivery of such services in one place is an innovation made possible through LIFT.

Therefore, design of LIFT schemes is challenging. Complexities lie within the need to provide therapeutic environments supportive to the healing process and the need for a patient-centred service model (Gesler et al., 2004). Also, the functional level of the buildings are complex, as different services need to be delivered jointly, and the service mix and ways of operation are varied and, in most cases, unknown at the outset. Buildings need to be flexible to accommodate future changes. There are also complexities at the architectural level as schemes need to be aesthetically interesting to attract people to use the facilities, promoting the health of the population.

5. Findings

5.1. Characterisation of the local LIFT as construction clients

The local LIFT project organisation involves a novel and complex structure with more than 25 public and private sector organisations, represented in Figure 1. A Strategic Partnership Board (SPB) comprising 6 PCTs at 3 local areas was set up. The SPB was responsible for selecting the private sector partner and was supported by a project team. PCTs were established 3 to 12 months before becoming involved with LIFT. Its staff had no previous experience with design/construction and the specific building type was novel.

FIGURE 1 HERE

Even though all stakeholders represented in Figure 1 could be considered as clients, we refer to the PCTs as ‘the clients’ because each PCT is responsible for the development of one or more schemes. The PCTs represent the Government through Partnerships for Health, the LIFT company, the Local Authority, the private sector partner and the specific tenants/users of each scheme. These groups had different stakes and interests over the schemes. Also, stakeholder groups differ from scheme to scheme in number and composition, and they changed over time. The tenants of the 4 schemes are described in Table 2.

TABLE 2 HERE

Due to the complexity of the organisation both in nature and size, and due to the inexperience of the teams, there was poor clarity of the organisational structure and of roles and responsibilities of each party. The description and diagrams presented above were developed by the research team, no such comprehensive review of the stakeholders had been undertaken before the research took place. This description was compounded by the research team and was later validated by interviewees.

5.2. Front-end process description

Figure 2 represents the front-end process as identified in the case study. A framework based on existing models was used to ascertain the type of activities undertaken by the client at the front-end. The process phases are based on the Process Protocol (Kagioglou et al., 1998) and the foundation elements were proposed by Khurana and Rosenthal (2002).

FIGURE 2 HERE

5.2.1. Phase 0

Phase zero involved the production of a document called Strategic Service Development Plan (SSDP) setting out the overall vision for 13 new schemes (SSDP, 2002). This document establishes the primary healthcare needs of local communities in terms of the condition of available estate and demographic profile.

The PCTs set up an internal LIFT team. Such team had the responsibility to establish an integrated project plan, identify, engage and represent scheme stakeholders, capture requirements, manage interfaces between designers, users and all organisations involved, control change requests and operational compliance, and sign-off requirements and designs (SSDP, 2002). The PCT board was responsible for ensuring schemes meet health and regeneration strategies, confirming affordability limits were controlled and engaging stakeholders in reviews (SSDP, 2002). The internal LIFT team reported back to the PCT board.

PCTs also needed to redesign healthcare service operations, establishing new ways of delivering primary healthcare to the community. Such redesign activities were essential as they should inform building design development.

We've got people who have never worked together before, independent GP's working directly with Practice Managers, PCT's, local authorities, community groups. So the public sector team … is working with people to understand how this will happen. How are you going to work in these buildings? Which is obviously part of the requirements in the first place – Local LIFT project director

5.2.2. Phase 1

Phase 1 focused on the selection of the private sector partner, and a description of requirements was needed to support it. Therefore, a consultancy company was engaged to produce a tenants' requirements document, which consisted of a template for all 13

schemes. At that point in time the membership of stakeholders to be hosted at each building was unknown, and consultation was ineffective. Consequently, the quality of the final tenants' requirement document was criticised, and there was a perception that not enough attention was given to the specific characteristics of each scheme.

…when I looked at those words, there was a lot of cutting and pasting going on ... and they weren't really well thought - Contractor's design manager

… it became apparent that the tenants requirement was non-specific and was risking the interpretation far bigger than we could afford or we could've anticipated – PCT representative

5.2.3. Phase 2

In phase 2, design proposals were developed by each company competing to be the private sector partner. However, architects had very little access to clients and no access to building users. There was poor information available on site and environmental issues and for some of the schemes there was uncertainty with regards to the viability of the selected sites.

The requirements weren't refined further. It was then, because it was a bid process, straight in, architects discussed with the PCTs, but they had a very short period of time to come up with some early design - Local LIFT project director

5.2.4. Phase 3

Finally, phase 3 focused on further developing design to allow the selection of the private sector partner. During this phase, while design solutions were proposed by architects, requirements were captured by PCTs through user group meetings and open public consultations. Requirements were sometimes conflicting between the diverse stakeholders, and were changing at each meeting/consultation. There was also poor linkage between the consultation process pursued by PCTs and the requirements being used by architects. Such segmentation led to requirements being inappropriately incorporated into design proposals and consequently wasteful redesign occurred.

A lot of things have changed over the last twelve months... I think it's because there's so many people feeding into the project that there has been a lot of change…. our primary contact is with the contractor, and even if someone contacted us from the PCT, and asked us to change something, we would have to get approval from the contractor to do that - Architect

5.2.5. Discussion

Even though the literature suggests that foundation elements should be defined before the front-end starts (Khurana and Rosenthal, 2002) at the case study the product strategy and specific building needs were defined and developed interactively throughout the front-end. For example, the prioritisation of schemes for development was defined during the front-end i.e. initially 6 schemes out of 13 originally proposed were selected for development, and subsequently 4 projects formed the first tranche of schemes. Also, specific requirements were determined during the front-end. Such uncertainties prevented the definition a project execution plan.

The proof of improving is when you start with a project plan and you deliver to time, cost and quality. We're not there yet, but I'd say they're only small steps - Local LIFT project director

As stated previously, wasteful redesign occurred due to a disjoint between requirements capture and design development, and also as a consequence of a poor understanding of financial issues. Requirement changes proposed by the PCTs after user group meetings were sometimes introduced in the designs without a prior evaluation of the financial feasibility of the changes.

…a lot of costs have built up... I'll give you an example. When I was at PCT [X], we had a public meeting, and an architect had come down... who was saying "Oh, yes you can. Yes you can have that." And then you go to a meeting following that, with a different group of people, and they change their wishes... what's happened across the PCTs was that, you come up with a design, sounds too expensive, so it has to be redesigned, down-sized – General manager LIFT company

In summary, poor management of the design front-end had a number of consequences. Firstly, there was major unnecessary design rework due to the weak development and understanding of requirements. Different stakeholders had varying requirements which were gradually introduced in designs. However, conflicts between such requirements sometimes got visible only after further consultation meetings, or after their inclusion in design, generating further redesign. Secondly, the quality of the designs was perceived to be poor, leading to extensive redesign after the selection of the preferred bidder. Finally, redesign led to postponements culminating in one year delay to reach financial close for the 4 schemes.

Therefore, within the primary healthcare environment, current procurement routes do not appear to recognise that the brief is an evolving process, as requirements are still being approached as a document produced at a specific point in time. Probably as a consequence of such approach, requirements were developed at the front-end in an unstructured, ad hock manner, with no single person responsible for their definition and management. Novice clients were capturing requirements through consultations, but with no change control mechanisms in place to support this process.

5.3. Front-end difficulties faced by clients

PCTs faced a number of difficulties which had negatively influenced design. These are briefly described as follows.

5.3.1. Insufficient resources available

The PCTs internal LIFT team members were developing LIFT activities alongside with their normal roles within the client organisation, and as a consequence insufficient time/resources were available.

5.3.2. Difficulties with decision making processes

PCTs had difficulties with its internal decision making. Decisions were typically made at four different levels to ensure that the investment was fully supported. Decision levels included the PCT LIFT team, a professional executive committee, PCT executive directors and local LIFT partner organisations. All decisions regarding building requirements needed to go through what was referred to at the interviews as a '*decision board*', which considerably slowed down the design process.

I think we had difficulty in understanding why you couldn't get an instant decision from people…why can't you just sign-off that document? How long is it going to take to get you to sign them off?... You are not going to sign them off because there are twenty or thirty different people behind it…however, the longer you delay, the more the costs go up - Local LIFT project director

5.3.3. Lack of process redesign expertise

At the early stages, process redesign expertise was not available at the PCTs, and not enough time was allowed at the front-end for service delivery redesign activities to occur.

I don't know what I would have done differently apart perhaps from engaging more service design capacity, more specialists in doing things like business process reengineering early on possibly. [That would have helped you?] Yes, because we have been trying to work with staff to do that, but we need a specific set of skills really - PCT director of developments

5.3.4. Poor definition of service models

As a consequence of the lack of redesign expertise, service models were not sufficiently defined when design development started. Therefore, the healthcare delivery system redesign was influencing and being influenced by specific building requirements.

One of the biggest tensions … is that the buildings agenda drives the process, rather than the service agenda... I have people who are managing it hard to meet the deadlines, and practitioners are saying we haven't got through that yet, so we don't know if we want that sink on the right or on the left hand side, so stop asking us until we have worked through that... there is a tension really in trying to control the flow … of aligning the service redesign processes and managing change with people… and the building is two steps ahead rather than the service redesign - PCT director of developments

5.3.5. Reliance on immature requirements

The tight links between the healthcare delivery system redesign and the definition of building requirements was not initially realised, and design proposals were developed based on requirements which did not have sufficient maturity, leading to redesign in downstream activities. With a poor definition of project objectives and priorities it was also difficult to identify stakeholders to be involved at each scheme, identify risks and value, or to define success criteria.

5.3.6. Difficulties with requirements management

Stakeholders and requirements were not prioritised nor evaluated against project constraints. In addition, different stakeholders were present at different requirements capture meetings. As a result, changes were introduced in the requirements after each meeting with a poor control of changes and inappropriate evaluation of the validity and affordability of changes.

The PCTs inexperience in relation to the design and construction process was well known from the beginning of the initiative. The private partner should support the client in terms of understanding the construction process, project managing the design front-end, capturing and managing requirements. However, such support was not effective due to the bidding process pressures.

5.3.7. Poor understanding of implications of changes

PCTs had poor clarity about the implications of extensive requirements and design changes in terms of time delays and costs. As novice clients, PCTs did not realise what design iterations could arise as part of design development and what iterations occurred due to poor decision-making processes and constant changes in requirements.

5.3.8. Summary

In summary, the overall level of novelty and inexperience has influenced the design front-end in the schemes analysed. The partnership was dealing with a multifaceted and novel product, i.e. new type of buildings, novel services delivered within them, and new procurement with novel legal and financial systems. The clients did not have experience with design and requirements management and was lacking appropriate support from construction professionals. These issues generated uncertainties at the front-end in terms of the processes to be followed and the roles and responsibilities of all involved, leading to excessive redesign and to a perceived poor quality of design.

6. Implications for requirements management

6.1. Clients activities

The results from this research evidenced the existence of two categories of clients' activities, which have been here classified as managerial and design, as represented in Figure 3. Managerial activities involve the (re)design of the clients business operations, as well as the definition of project management structures and decision-making processes. Design activities are those necessary to provide the design team with information to develop design solutions, i.e. the definition of the building vision, project priorities and appropriate building requirements. These activities were previously described in the literature (see Table 1), however classifying them in groups by understanding differences in their nature is positive as it makes explicit the skill sets necessary to develop each type of activity. It also makes clear the relationships between the activities with different natures, i.e. clients need to have clarity on managerial activities in order to support design related activities.

FIGURE 3 HERE

6.2. Need to balance the redesign of business operations and building requirements and provide necessary skills

Managerial and design activities are interrelated. For example, there is a very tight link between the clients' business operations (its design and redesign) and the definition of building requirements. Part of the clients' business operations may be known at the outset; however some will evolve alongside the front-end development. Consequently, it is important to achieve an appropriate balance of the interactions between the two; i.e. insufficient interactions may lead to unsuccessful outcomes, while excessive interactions may lead to wasteful design changes and time delays. Also, when changes are predicted at the level of business operations, knowledge and skills on redesign at the client organisation is important to support the achievement of appropriate results.

6.3. Requirements maturity

The level of maturity of the requirements is linked to the maturity of the redesign of the clients' business operations, as well as to the availability of information, or level of uncertainty at the front-end. As pointed out by O'Brien and Smith (1995), requirement maturity is often related to the formal stage of development that the requirement has reached, and to the need to re-express information in more precise terms to suit design.

6.4. Role of requirements

Research results also indicate that requirements have different roles for different stakeholders, i.e. designers consider them as the means through which design could be developed, while clients perceive the requirements as a way to better understand how to deliver innovation at the healthcare system level by agreeing on building characteristics.

However, there may be tensions between stakeholders due to such differences in the requirements' role, e.g. clients need time to establish building preferences and designers need mature information to develop design proposals. In this sense, the social and political context in which the front-end develops influences the requirements. The different roles of requirements pertinent to each stakeholder group should be clarified at the outset, and an independent person should be responsible for its management.

6.5. Importance of appropriate decision making structures within the client organisation

Difficulties in decision-making may lead to a delayed definition of requirements or to excessive design changes. The clearer and simpler decision-making structures are, the more responsive the client organisation will be at the front-end. To allow this, the client representative needs to be empowered to make decisions on behalf of the client organisation (Green, 1996). The concept of sign-offs, its importance over the process and the consequences of delayed decisions also need to be clarified at the outset.

6.6. Importance of considering clients complexity

At the case study, PCTs faced problems in defining requirements due to difficulties in identifying who the stakeholders where, and also due to constant changes on the tenants/users membership. Such complexities made it difficult to define a set of composite building requirements considering the different project constraints in practice. In this way, complexities at the level of the stakeholders lead to complexities in the front-end and specifically requirements capture/management processes.

Therefore, the more the stakeholders' complexity the greater the importance of employing structured approaches to manage requirements (Cooper and Press, 1995). Novice and complex clients need to gather requirements, but they should understand the need for prioritisation, i.e. ranking stakeholders' importance and ranking requirements, as well as knowledge on the tools and techniques available. It is likely that the client will not have such knowledge readily available, therefore training and support through external specialists might be necessary.

In summary, appropriate training and/or support must be in place for clients to be effective in design. This may include making available resources with sufficient skills and knowledge on how to capture and manage stakeholders' requirements. The responsible for managing requirements should be able to ask the right questions at the right time. Therefore, a question for further research is posed: who would be the most appropriate stakeholder to provide such support and what specific skills should s/he have?

7. Conclusions

Novice construction clients need appropriate support to be able to understand and perform their activities during the design front- end. This is especially true in the design of primary healthcare facilities, where healthcare service redesign highly influences building design.

For LIFT schemes in general, there is a major challenge in aligning the service agenda with the buildings agenda, i.e. providing accurate information for building design while at the same time defining strategically and operationally service delivery to provide adequate information for design development. The achievement of this balance depends on the recognition that some building and service requirements will evolve concurrently and therefore time and support for innovation should be allowed at the front-end. Knowledge and skills on healthcare systems redesign is essential for appropriate results to be achieved. In this way, PCTs could better understand and therefore would be better able to describe healthcare operations to designers at early stages.

The literature has addressed the need for novice clients to reach a clear understanding of their own activities in a project in a detailed level, and of other stakeholders' activities at a broader level, before embarking on a project. Knowledge on design and construction stages, activities, and stakeholders should be sought, including the types of decisions that need to be made at each stage, and the consequences that changing decisions can have on the process. The level of detail on information needed from the client at each stage should also be clear. Such understanding should help clarifying the interfaces between designers and clients in defining/refining requirements, as well as on the type of support that can be expected from designers, especially at bidding situations. In such way, clients can also appreciate the effort needed for design, allocate appropriate resources, and understand who should provide them information and

support when needed. Further efforts are needed to establish effective ways to achieve this in practice.

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Table 1: Construction clients' activities and potential difficulties for novice clients

Clients' activities	Description	Difficulties faced by novice clients
Describe business operations	• Holistic approach, including changes on operations that the new facility should address (j) • Requirements capture and procurement of a project should be integrated with the organisations ongoing business activities (d, i) • Designers need to have background information about to the company to produce a brief (b) • A more thorough evaluation can lead to improved versatility and flexibility of the selected project option (b, c ,f)	• Its difficult to naive clients to describe their operations to another party (d) • It is difficult to achieve a clear formulation of service needs, functional needs and objectives (c)
Identify stakeholders	• Define user groups through which preferences will be established and building features evaluated (e, f, h) • Identify stakeholders (d, j) • There is a need to gather project stakeholder information but be able to prioritise the factors (d, i)	• It may be difficult to identify all stakeholders that need to be involved in design at its preliminary stages as there are many uncertainties in the process (c) • It may be difficult to prioritise requirements from different stakeholders (a, d, i, g, k) • Representation of client interest groups may be difficult (a)
Understand construction process	• Outline project stages (b, d, e, g) • Timescales for each stage, identifying project milestones (b, d, i, l) • Set out when client needs to be consulted in the process (j, h, f) • Client commitment to the project (b, c ,h)	• Complexities of the construction process and uncertainty, specially at the front-end (a) • Being able to allow enough time at the front-end to get familiarised with construction and to develop an appropriate brief (a, i, j) • Lack of experience of the client with the industry (a)
Procure and determine project team	• establish a good relationship with suppliers at the front-end (e , h, l) • make a realistic financial commitment from the outset (j) • adopt integrated processes with clear and fair working arrangements (g, j)	• After initial design is finalised, the client almost always needs to make hard choices to comply to budget (j)
Decision making and sign-offs	• Define a decision making process ensuring decision criteria are made explicit and systems are in place to control time, costs, quality and changes (d, g, l, j) • Establish project management structures (b, d, j) • Sign-off different project stages (b, d, g, j) • Review designs regularly (3D) including schedules of accommodation and room data sheets to incorporate into and compare with the brief (j)	• It is difficult for naive clients to understand the implications of changes after sigh-offs in the process in terms of time delays and costs (d, j).
Project management: define a client in-house team	• Appoint a client representative project manager (d, h, j) • Empower representative to make decisions(d, e, l, j) • Coordinate the project and ensure deadlines are met (b, c, d) • Establish appropriate communications (c, h, j, l) • Roles and responsibilities must be clear (e, j)	• Inexperienced clients may not be sure of what they are expected to do during the construction process. In the majority of the projects, clients will be expected to undertake specific duties; consultants should ensure that the clients are specifically briefed on their duties (d)

Define building vision, aims and project objectives/priorities	• Provide leadership for the construction process (j) • Define project/priorities objectives and measure project success against them (b, g, j, k) • Identify risks and value (b, c, g) • Objectives must be clearly understood and shared in the client organisation (j) • Respond and contribute to the context-neighbourhood (j) • Integrate business strategy, building requirements and strategic brief (b, d, g)	• It is difficult to clearly set priorities at the outset (d, j, l) • Clients need time to explore options, get data on which to base decisions, communicate carefully with all concerned, and to decide what help to seek (d, c). • Pressures to complete buildings as soon as possible could lead to poor results (g, f) • Identifying client needs and interpreting those in building terms may be challenging (a, i)
Explore benchmarks and learn from past projects	• Get enough time at the front-end to learn from successful projects (j) • Visit places with designers, so that they can better understand clients values (j, g) • Post-occupancy evaluations (j) • Commit to sustainability (j) • Conduct evaluations of recent relevant projects in the pre-project stage of new projects so that stakeholders within the client organisation feel motivated to evaluate buildings and clearly perceive benefits in doing so (i)	• Reaching a clear understanding of the project's potential and examining successful projects for benchmarking takes time (j) • There may be little transfer of knowledge between projects even within organisations that construct similar projects and have elaborate procedures in place (i)
Project and design brief	• Be aware of project constraints (b, d, l) • Gain support from senior managers (a, d, e) • Communicate with designers (b, c, e, h) • Understand that briefing is an iterative process (b, d, i, j) • The brief should describe vision, operational requirements, desired image, quality, and criteria for site selection (b, j) • Seek user representation (d, h, i, k)	• People within client organisations will not always agree what criteria a building should meet. This can affect the progress of the project. Consensus should be sought, and if it is not achieved, consultants need to be made aware of potential political difficulties and discuss the best possible approach (d ,h) • The design team is characteristically briefed by those who commission and pay for the construction, whose members are least likely to hear the voice of those who will actually occupy the building (i) • Client needs to achieve an understanding of the brief and of the problem(s) it is attempting to solve (c, h)
Requirements	• Involve users and collect user information (a, b, c, d, e, h, l, ,j, k) • Capture, explore and prioritise requirements and clients needs (a, d, b, c) • Reach consensus on requirements within client organisation and with users (,b, c, d, f, g h) arbitrating between conflicting demands from user groups, specialist groups, facilities managers, etc • ensure that the critical assumptions made are valid, realistic and achievable (b, c, g)	• Clients are not always sure of their requirements; when considering project constraints, clients should try to prioritise their requirements (b, c, d, e)

Key:

a. Kelly et al. (1992)
b. Cooper and Press (1995)
c. Smith et al. (1998)
d. Barrett and Stanley (1999)
e. Bruce and Cooper (2000)
f. Kamara et al. (2000)
g. Blyth and Worthington (2001)
h. LEAF (2001)
i. Luck et al. (2001)
j. CABE (2003)
k. Darlington and Culley (2004)
l. Bertelsen and Emmitt (2005)

Table 2: Tenants and users for the 4 first trench schemes, according to interviewees

Scheme1, PCT 1	Scheme 2, PCT 2	Scheme 3, PCT 2	Scheme 4, PCT 3
• PCT • Senior GPs from 2 practices • Local Authority (site owner) • Healthy living centre • Dental community services • Ambulance Service • General public through consultations	• PCT • Forum building linked with the healthcare facility • City passenger transport executive • 3 GP practices • Dental practices • Local Authority • General public through consultations	• PCT • Housing Trust – land owners • Community services • 2 dentists • 3 GP practices • Clinical services • Podiatry • Minor operations • Mental health • General public through consultations	• PTC • CHAPS – Community Health Action Programme • Roman catholic church (neighbours) • Local Authority • General public through consultations

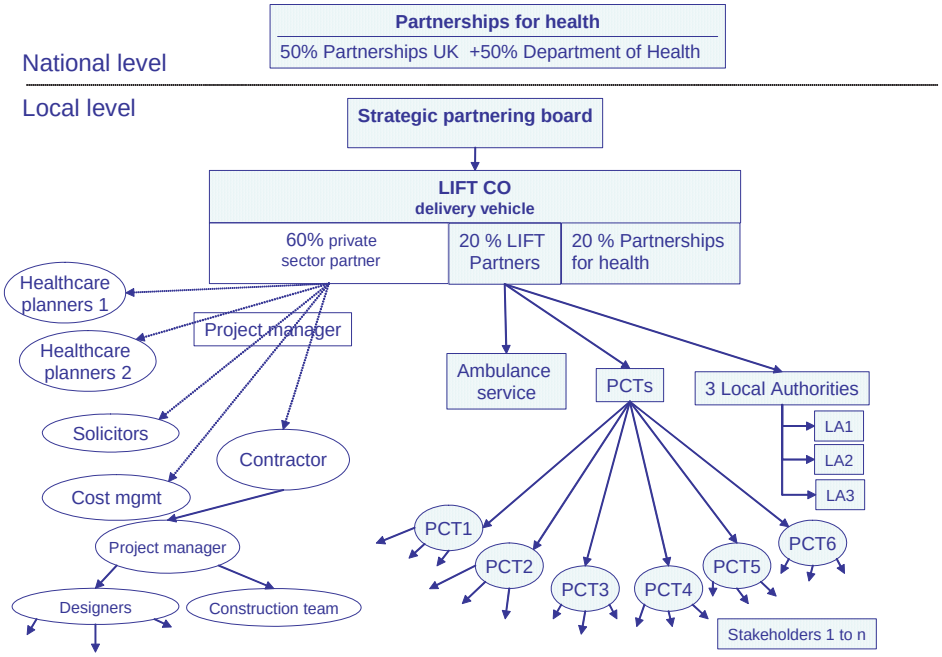

Figure 1: Organisational structure of the local LIFT – shadowed boxes represent clients

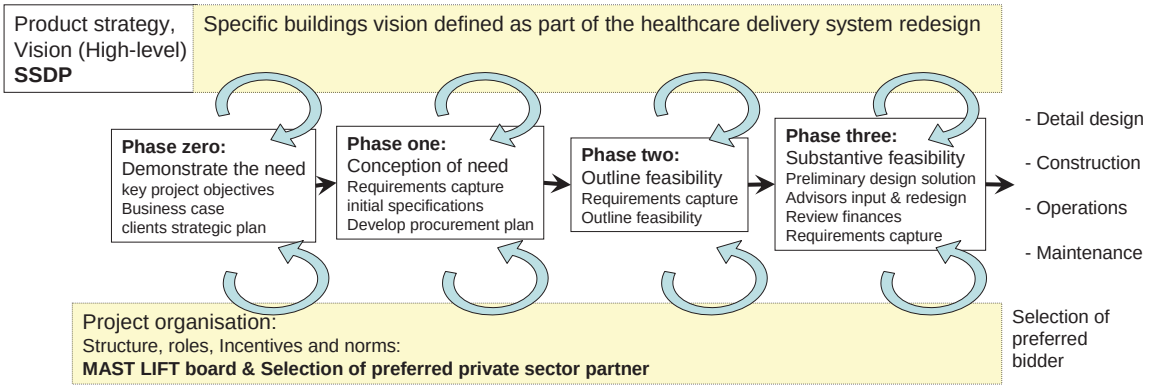

Figure 2: Design front-end on 1st tranche local LIFT schemes

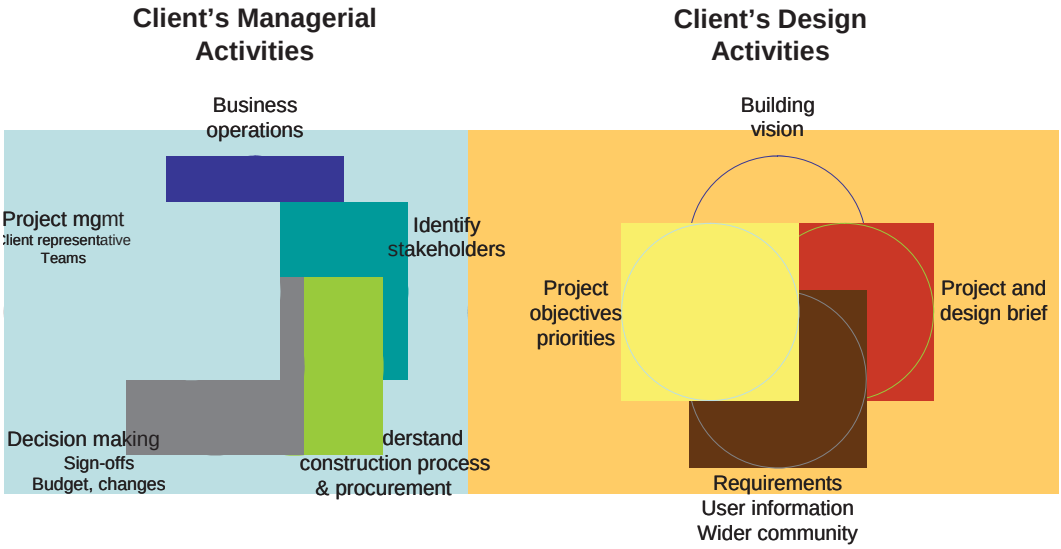

Figure 3: Main managerial and product development client activities at the design front-end