Chapter 2: Motivation

2.1 Problem statement

The purpose of this study is *firstly* to study well-established techniques from the world of manufacturing, the characteristics of design and Artificial Intelligence (AI) to understand the characteristics of the early phases of architectural design better and to discover if a significant improvement can possibly be made. *Secondly* an attempt will be made to establish a simple design language to support the life cycle of a construction and *thirdly* to build a prototype design processor that could use the design information.

2.2 Sub-problems

Sub-problem 1: Can design requirements be sufficiently structured in functions that lead to design elements and specifications to facilitate the storing of design knowledge?

Hypothesis: A building can be seen as a production product and hence established Systems Engineering techniques and quality control measures can be applied to the briefing and design process.

Assumption: Due to the high cognitive content of design it is assumed that techniques from the manufacturing industry will only partially solve the problem and therefore a bridging technique (non-prescriptive) between the capabilities of the human brain and systematic approaches will have to be established.

Sub-problem 2: Can a flexible, multimedia database structure that addresses the total life cycle requirements of a building be created using existing software?

Hypothesis: The architectural briefing and design process can be structured in such a way that it can be implemented on a software system to ensure total life cycle design.

Assumption: The structuring and storage of design information will become more important than the software application that originally created it. Although very complex Building Product Models exist at this stage an attempt will be made to use the technologies offered by the Internet.

Sub-problem 3: Can software object technology be used to store architectural designs in such a way as to expedite future designs.

Hypothesis: Architectural designs and design parameters can be quantified and electronically packaged in such a way as to expedite future designs that require similar designs or parts of designs. Concurrent briefing and design processes can be implemented on the www within a multi-disciplinary team on a global basis.

Assumption: Integration and structuring of the structured multi-media design information is essential if global competitiveness is to be achieved. It is further assumed that this should be the basis on which organisational processes should be built.

2.3 Bounds and constraints

It is assumed that the present theoretical basis in diverse fields such as software object technology, Systems Engineering, QFD, TRIZ, Kansei Engineering and CBR is sufficiently developed to enable the implementation on desktop based software system operating in a client-server mode or an Internet based Knowledge Portal. Such a system should be implementable on present desktop computers using Microsoft Windows 95, 98 or NT and standard hardware. The project will not attempt to develop a full commercial system, but will concentrate on a framework and certain sub-modules to illustrate the principles due to financial and time constraints.

The following strategic assumptions are made:

- Microsoft products such as the Windows operating systems, office integration products, object technologies and Internet browsers will remain influential in the short to medium term.
- The Internet/ World Wide Web will be the main information network in the world and the preferred infrastructure for global e-commerce and data exchange.
- Hypertext Mark-up Language (HTML) and Virtual Reality Mark-up Language (VRML) will continue to dominate the www. The new Extensible Mark-up Language (XML) standard as defined by the World Wide Web Consortium 10 February 1998 (http://www.w3.org/TR/1998/REC-xml-19980210) provides a useful basis for the implementation of a flexible and neutral design language. The co-existence of diverse and distributed sources of design knowledge at different levels of specificity rather than a centralised object store.
- Internet based subscriber services will become prominent. This is confirmed by Internet service providers such as ZoomON (http://www.zoomon.com) and Autonomy (http://www.autonomy.com).
- Java, Visual Basic Script (VB Script) and Visual Basic will be the language of choice for Internet applications (Bouzeghoub *et al.* 1997; Lomax 1997).
- Microsoft ActiveX will gain more prominence than CORBA (Lomax 1997).

2.4 Research method

This research attempts to create a prototype generic software tool that could aid the early difficult and conceptual stages of design whilst at the same time aiming as low as possible. Aiming low implies the creation of a non-prescriptive affordable tool that can readily fit into any Microsoft Windows compliant container environment, integrated into third party software or be used directly in the Internet. The tool should be usable on the desktop and should be non-CAD centric. The prototype software system will be implemented by means of existing software techniques and products such as Microsoft Internet Explorer, Visual Basic and Microsoft Personal Web Server. Object oriented technology will be used as far as possible.

Simultaneously well-established techniques such as Business- and Systems Engineering, Kansei Engineering, Fuzzy Sets, QFD, Taguchi Techniques, TRIZ and Case-Based Reasoning will be used as a reference framework for the prototype software system.

The results of a recent extensive QFD exercise from a cross-section of construction professionals in the South African construction industry will be used as a means to guide the general direction and characteristics of the generic software tool mentioned above. (Küsel 2000).

Over the past 35 years commercial CAD systems have had little impact on the early, conceptual stages of design. This is the phase where the maximum benefit over the life cycle can be realised at the minimal cost. This inadequacy is further exacerbated by the pressing need to follow a total life cycle approach to architectural briefing and design. Eastman (1994:95, 1999) indicates how long efforts to develop integrated backend databases to support architectural design and construction have been going on. Except in special cases, these efforts have not been very successful.

New product design and development paradigms have emerged in other fields of expertise, yet no total design system exists to address the high level of design complexity in a global architectural environment, one that uses the world wide web (www) without compromising aesthetics and ethics. There is also a clear indication that Knowledge Management (KM) is becoming very prominent.