Educational strategies for architectural design management : the design of a new curriculum

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Educational Strategies for Architectural Design Management; The Design of a New Curriculum

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Abstract
This paper is about the design of a new curriculum on Architectural Design Management Systems. This curriculum is embedded in the Stan Ackermans Institute(SAI). The SAI is a school for continuing post graduate education on technological design.
First some recent developments in the building industry will be discussed. These developments form the background for the definition of a new specialist: the design manager. Within the context of this background the design for a new curriculum is discussed.

Keywords: Design Management, Educational Strategies, Curriculum Design

1. Developments in the building industry

The building industry always has had some special, problematic characteristics which strongly distinguishes it from other fields of industry. Some of these characteristics are:
- Building life cycle costs are hardly predictable because of the long life span.
- Every newly designed building have unique characteristics and is more or less invented on it's own, with consequently also unique building process characteristics.
- Most building projects are uniquely organised cooperations on a project basis between a number of building partners who are not familiar with each other.
- Within the building process there are complex, demanding and changing responsibilities between the partners.
- The degree of design specification of buildings is relatively high in a functional as well as in a technical sense, which impedes project independent innovations.
- Traditionally the building sector is price competitive, instead of quality competitive, which also doesn't stimulate innovation.
- Profit and risk margins are extremely low compared to development and production costs.
- The building sector is strongly fragmented into a lot of independent firms.
- Due to the characteristics of the building sector, short term project management, often overrules long term strategic management.

Until the recent past the building sector, in terms of applied technology and organisational forms, was a relatively stable sector of the industry. Nowadays technological, socio-economic and political developments are drastically and irreversibly changing roles and responsibilities in the process of architectural design and construction.

Some of the most remarkable changes are:
- Traditionally the building industry could be characterised by price competition. Since April 1987 there is a so called open European market with an enlarging field of competion, which is becoming more quality- than price based.
- Increasingly the building sector is confronted with professionalised clients. Firms are strongly focussing their efforts towards their core business. Management of accomodation needs is delegated to professional firms that develop and own business buildings.
- Budgets and time limits are sharpened. Besides initial investment costs, life cycle costs more often are considered to be the basis of design decisions.
- The traditional triade in terms of client, designer and contractor with their traditional role patterns is past. In almost all recent building processes there is an increasing number of participants in the design process. This is especially the case for the equivalent participation of engineering experts in the design process.
- Buildings are becoming more and more complex in technical as well as in functional terms.
- The amount of professional and legislative regulations is drastically increasing.

For a more elaborate reasoning about these developments described before we refer to Bakens (1995), EIB (1991), Houben (1992), Maliepaard (1988), MVROM (1992), Pries (1995), Roelofs (1996). All these developments, together with the special branche characteristics noted above, give reason for a growing need for adequate and continuous mutual adjustment, planning, and control of the design process.

To manage the increased complexity and speed, it is required to provide additional vehicles to support an effective, efficient design communication and decision making process between design and building partners, suppliers and other stakeholders (Gray et. al, 1994).

For the sake of argument, the building process may roughly be divided into four phases: initiative and briefing, design and engineering, construction, and exploitation.
For the initiative and briefing phase one can buy knowledge and expertise from accomodation consultants.
For the engineering and construction phase there are a lot of professional building project managers on the market.
For the exploitation phase there are facilities- and real estate managers.

Because of a lack of competition for the design phase, up till now hardly ever the advantage was taken of the expertise of professional management consultants. Project management in the design phase traditionally was considered to be a core task of the designer. In the last few years one can notice that the accomodation consultant or the building project manager are also commissioned to facilitate the design process. Neither of them however are professionally equipped to control this complex and most determinative phase of the building process.

A design manager must be able to design adequate process strategies for complex design processes, and has to be able to implement these strategies into practice. Besides this, a design manager must also be able to specify or adapt professional -automated- management systems intended to facilitate the planning, monitoring, and controlling cycle of time cost and quality in the design process.

Given this task profile, the design manager may be an architect with above all managerial qualities, or a management consultant specialised in the field of design and building processes. They may be employed for instance by a design office, a professional contractor, client or a management consultants office.

The new school on Architectural Design Management Systems (ADMS) at the Eindhoven University of Technology, aims to educate this type of design management professionals.

2. The organisational context of ADMS

The ADMS school is a collaborative initiative between the Faculty of Architecture Building and Planning and the Faculty of Technology Management of the Eindhoven University of Technolgy. The school is embedded in the Stan Ackermans Institute (SAI). The SAI is a school for continuing post graduate education on technological design.

The ADMS school aims to attract young engineers with a building-, civil-, or business- engineering degree on an academic level. It is a full time two year course. The Dutch post graduate design courses aim to educate professional designers who are able to improve the international competitive position of the Dutch industry.

The quality of the ADMS school is assured by representatives of leading firms in the Dutch building industry as well as by a number of academic and governmental institutionalised boards.
Start date of the ADMS school is September 1996.

All students will be employed at the Eindhoven University of Technology, and will earn a salary based on a position as 'research assistent'.

The given organisational context implies that the ADMS school is especially directed to young engineers with no practical experience. Therefore it is not expected that after graduation, ADMS students are employed directly as design managers. It is even not the aim to educate pure management professionals, although the possibility for a professional management career in the building field is certainly not excluded. After graduation, ADMS students predominantly will be employed in staff functions to design and control design processes.

3. The structure of the ADMS curriculum

Basically the ADMS curriculum has four parts:
- A homologation module in which general initial building and management knowledge is lectured.
- A module directed to domain independent skills.
- A main module, directed to architectural design management systems.
- A final ADMS design project (examination) to be executed in practice.

In figure1 this main draft of the ADMS curriculum is represented. On the top left side of the boxes, for each of the main modules the studying load for the students is specified in hours. The total amount of studying hours is based on a year of 1680 working hours.

3.1 The homologation module

The main aim of the homologation module is to achieve a shared knowledge reference for ADMS students.

Students with a business engineering education will follow initial building courses. Students with a building or civil engineering education will follow initial management courses. After having followed this module, students are considered to be able to indepentently acquire domain bound ADMS knowledge and to communicate effectively with all the professional design participants.

ADMS students with a building or civil engineering education have to follow courses on:
- organisation and management science
- business economics
- marketing
- business law
- project management
- quality management
- operations management
- entrepeneurship and management of small and medium enterprises (SME's)
- management aspects of information systems
- a small management consultancy project to exercise the acquired knowledge and skills.

ADMS students with a business engineering education have to follow courses on:
- building technology
- detail design
- concrete, steel, wood and brickstone structures
- building physics
- cost planning of buildings
- building economics
- site planning and building construction
- architectural history and theory
- organisation of the building process
- modelling with CAD systems
- building information systems
- building law (private and public)
- small architectural design project to exercise the integration of architectural design and building production.

MODULE A 920 SH

HOMOLOGATION: GENERAL BUILDING AND MANAGEMENT DOMAIN KNOWLEDGE

MODULE B 190 SH

DOMAIN INDEPENDENT SKILLS

MODULE C 1000 SH

ARCHITECTURAL DESIGN MANAGEMENT SYSTEMS

| ORGANISATIONAL CONTEXT | DESIGN OF THE DESIGN PROCESS | KNOWLEDGE CONTEXT |

CASE STUDY

MODULE D 1250 SH
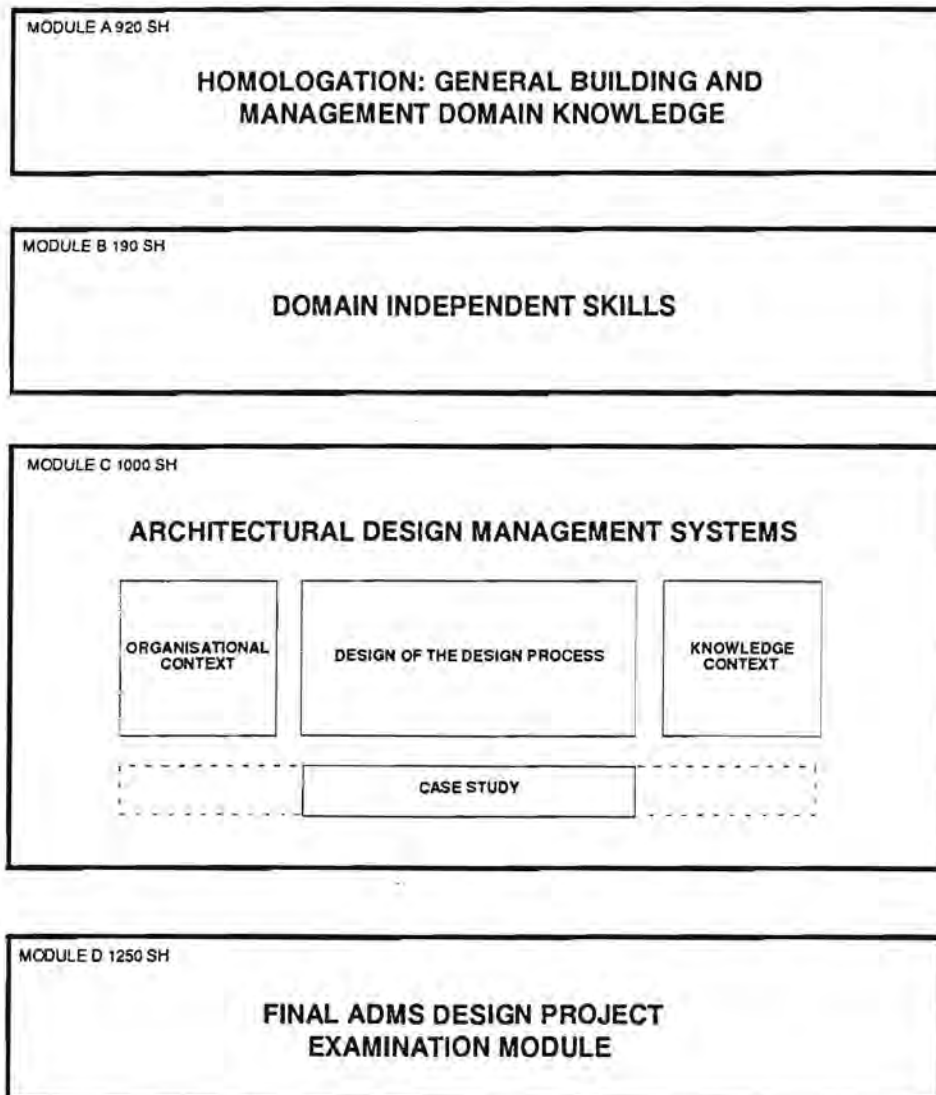
FINAL ADMS DESIGN PROJECT EXAMINATION MODULE

Figure 1: Structure of the ADMS curriculum.

3.2 Domain independent skills module

This module aims to acquire personal rather than technical skills. The courses and trainings given here are a selection of the whole range of courses the SAI offers on this area. All these courses and trainings are specially developed on a post doctorate level for the SAI institute. The courses to be followed are:
- negotiation and convinction
- meeting techniques and communication
- leadership and collaboration
- interviewing
- presentation techniques.

3.3. Main module directed to Architectural design management systems

This part of the curriculum forms the core module of the ADMS curriculum. The main module consists of 11 parts. They can be clustered in four main elements:
- An element directed to organisational context of building and design processes
- An element directed to the knowledge context of the design management process
- An element directed to the design of the design process
- A case study project

After having followed this main module successfully, students are considered to be able to independently execute ADMS projects in practice. In figure 2 the detailed structure of the main module is given. Each of the curriculum elements presented in figure 2 will be discussed in more detail below .

3.3.1 Organisational context of building and design processes

- Building processes and building organisation
This course is about the organisation and content of the total building process. It is especially directed to the integration of the design process with the briefing- and engineering phase. Also attention will be paid to special -European- organisational forms of the building process like management contracting, design and build, turn key etc.

- Organisation and management of the design office
In management terms design offices are characterised by a relatively flat hierachical structure, in which persons, working on the lowest level of the hierachy have a lot of independent responsibilities.
Besides that, since designing is a creative process, managing design professionals requires special leadership skills. How design offices are professionally organised and managed is the main theme of this course. Attention will be given to the implementation of special management systems within this type of organisation.
Furthermore all professional business aspects of architectural design offices will be discussed.This special topic in the course among others will be taught by the Royal Institute of Dutch Architects (BNA).

3.3.2 Knowledge context

- Building information systems
In terms of studying hours, the course on building information systems is one of the more essential parts of the curriculum. In this course three types of information flows will be discussed:
- the information flow on the management level between participating building firms
- the information flow between participants directly of diverse firms involved in the design and building process
- the information flow within the respective firms between the management level and the persons involved in the design and building process.
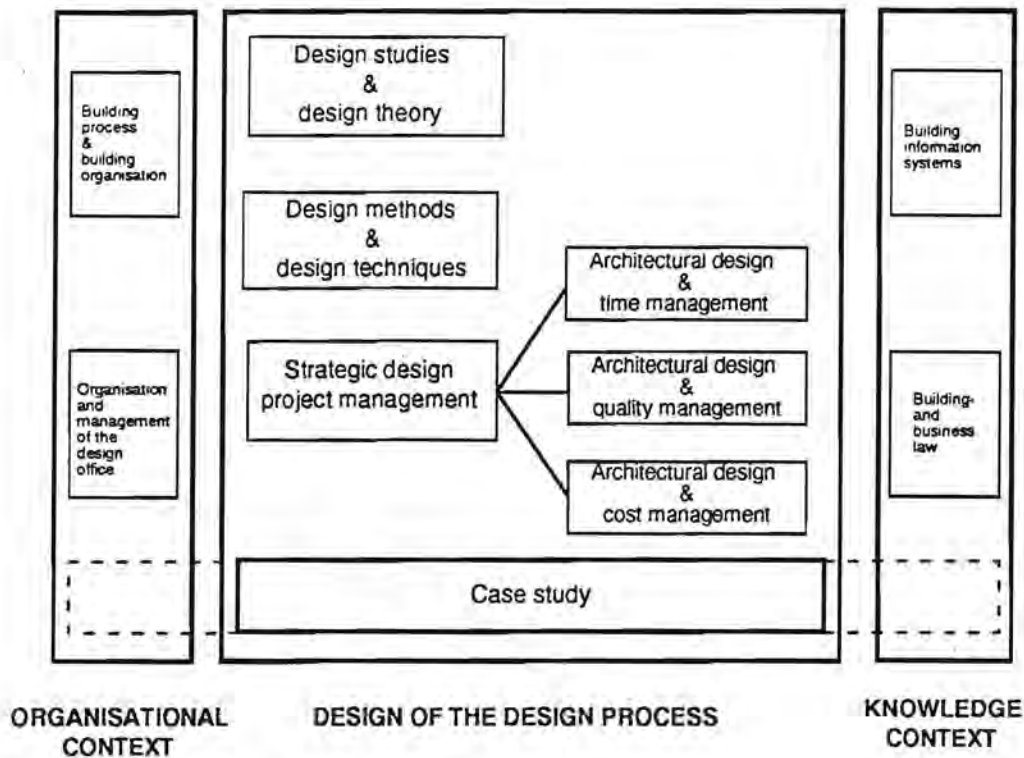
Figure 2: *The structure of the ADMS module*

Special attention will be paid to advanced product- and process modelling techniques and virtual reality systems.
The full course is especially directed to automated management systems and their adaptation and implementation in the building industry.

- Building - and business law
This course is about public and private aspects of building law, as well as about the legislative aspects of small and medium enterprises. Special attention will be given to the legislative aspects of European projects, contracting, and legislative responsibilities.

3.3.3 The design of the design process

- Design studies and design theory
To analyse the architectural design process and to effectively communicate about it, a basic theoretical understanding of models and definitions is absolute necessary. This is the type of knowledge which will be taught in this course.

- Design methods and techniques
After having acquired general theoretical knowledge about the architectural design process, in this course the methodological aspects will be thaught.
The course is directed to concrete methods, techniques and alghoritms used in the actual practice.
Special attention will be paid to strategic aspects and the computerisation of the design process with advanced CAD tools and design decision support systems.

- Design project management

In this course the general principles of project management will be implemented for the management of the design process. It is an introductory course for the following three courses which are directed to the management of time cost and quality. The focus of this course will be on the strategic aspects of design management, the project culture, the organisation of the design team, phases of the design process, roles and responsibilities of the design team partners, change control, information management and evaluation etc.

* Architectural design & time management

Time management is an essential part of design management. In this part of the curriculum attention is given to programming tools like network, network planning, procurement schedules, information required schedules, information transfer schedules, etc.

* Architectural design & cost management

Attention will be given to the costs of the design process as well as the optimisation in the design process of initial investment costs and life cycle costs of buildings.

* Architectural design & quality management

Quality management in this context is about the quality of the architectural design process as well as of the resulting design, however the focus is again on the design process. Quality of the design process is directed to ensure that every step in the process is complete, correct, just in time and without inefficiencies. Special attention wil be given to the implementation of the ISO 9000 certification process in architectural design offices.

In all three special courses attention will be given to existing automated tools and techniques and their implementation in the architectural design process.

3.3.4 Case study project

The case study aims to integrate all the acquired knowledge and skills of the main module in one integrated piece of work based on a real project.

The case study will be executed as group work. Special sub-tasks will be specified which have to executed by two group members with respectively a building or civil engineering background and with a management background. The case study consists of four parts:

- an inventory and formal description of an existing building design project (brief, design team organisation, organisations of design team partners, organisation of the construction team, phase documents, used methods, tools, techniques, design guides and design norms, work brake down structure, contracts, change control system, time planning and control, cost planning and control, implemented quality management systems etc.)
- an analysis of the prescribed process design and of the actual design process, together with an explanation why the process design is designed on the way it was. Special attention will be given to the dependency of the process design related to: the design team composition, organisations involved, building process organisation and the project type.
- proposals for the improvement of the process design and for the implementation of management systems within the analysed design process.
- a written and oral coherent presentation of the full case study

3.3.5 Didactical model of the main module

Every course in the main module starts with a small overview of the state of the art in that special area, taught by academics as well as practitioners. After this short introduction ADMS students have to acquire further knowledge independently by means of a literature survey. The themes of these knowledge acquisitions will be coordinated by the course teachers and by the coordinators of the main module.

After the literature survey the ADMS students are expected to write a review paper. This is one of the vehicles by which the ADMS school intents to develop an accurate body of knowledge of the field of architectural design management.

3.4 Final ADMS design project (examination)

The aim for this -examination- module is that the students demonstrate that they are able to make either a design for a design strategy, a design decision support tool, or an implementation strategy for such a tool, within the context of a large and complex design project.

The final design project aims to integrate all the acquired knowledge and skills in one design project. A project consists of approximately 1250 working hours. Enterprises that offer such projects to the SAI have to pay a part of the salary and research expenses for the students.

The final ADMS design project is part of the strategy of the ADMS school to acquire adequate and actual knowledge in the field of Architectural Design Management.

4 Research perspectives

As stated before one of the aims of the ADMS school is to acquire advanced knowledge in the field of architectural design management systems. This drive is motivatedbecause of the lack of a coherent established body of knowledge.
Knowledge acquisition will take place by:
- The thematic literature surveys executed by the ADMS students in the context of the courses of the main module. These literature surveys will give an overview of the state of the art in research on architectural design management systems. An edited compilation of literature reports and course introductions have to result in a textbook on architectural design management systems in the future.
- The case study projects of the main module that will give insight in actual processes in practice.
- The final design (examination) projects will also form a challenging opportunity to acquire and advance adequate and up to date practical knowledge

Within the context of the knowledge acquisition worked out above some programmatic research themes have been formulated. These themes are:
- an overview of the state of the art of the results of academic research on architectural design management and design management systems
- an inventory of design guides, -tools and -management systems, applied in practice from an European perspective
- knowledge and insight in the feasibility of the implementation of management perpectives within the architectural design process
- the development of concrete architectural design management tools
- knowledge and insight in the design of design processes in practice

5. Discussion

As has been stated an ADMS student after examination must be able to design adequate process strategies for complex design processes, and has to be able to implement these strategies into practice. Besides this, a design manager must also be able to specify or adapt professional -automated- management systems intended to facilitate the planning, monitoring, and controlling cycle of time cost and quality in the design process.
Given this task profile, the design manager may be an architect with above all managerial qualities, or a management consultant specialised in the field of design and building processes. They may be employed for instance by a design office, a professional contractor, client or a management consultants office.

In the discussions with professional practitioners and other relevant Dutch educational institutions, some critical points of discussion were made in reaction to the preliminary plans. The main discussion points were:

- Architectural design manangement lacks a well defined body of knowledge. A lot of knowledge has to be mapped, categorised and developed.
  Because of this lack an explicit choice has been made for a didactical model in which we have challenging and tremendous chances to advance the knowledge on ADMS.
- The existing professional parties in practice, sometimes have to be convinced of the necessity of the design management function as a separate discipline. Especially some architects might be afraid of the reduction of tasks which they consider to belong to their traditional professional domain.
  Even though this may be true, seen the recent developments in the building industry on a national as well as on an international level, the ADMS scholars are convinced that the design management function will appear to be essential in modern building processes.
- Especially for the students with a degree in business engineering it might appear to be a difficult task to acquire sufficient knowledge and insight in the field of building design and building engineering to function on a proper way as architectural design managers.
  Every ADMS student of course has and will keep his own profile. Seen the broad professional possibilities for architectural design managers in practice the ADMS scholars think that students with a degree in business engineering will have a promising future. ADMS students with a MSc background in business enigineering will most likely occupy professional positions within management consultancies and large -civil engineering- contractors.
- A design manager must have at least several years practical design experience with complex large architectural projects before he or she can properly act as design manager.
  The ADMS school will operate closely related to the actual Dutch building practice.
  As has been stated the given organisational context implies that the ADMS school is especially directed to young engineers with no practical experience.Therefore it is not expected that after graduation, ADMS students are employed directly as design managers. It is even not the aim to educate pure management professionals, although the possibility for a professional management career in the building field is certainly not excluded. ADMS students predominantly will be employed in staff functions to design and control design processes.
- The title Architectural Design Management Systems gave some people the idea that it is the aim to educate special architectural software engineers.
  Software engineering is explicitly not the aim of the ADMS school. The focus is on the design of design processes and within the context of this activity on the selection, adaptation and implementation of advanced -automated- management tools in practice.

6. Acknowledgements

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