Interdisciplinary Design of Systems for Management and Architecture

Mark Mobach
Research Fellow, University of Groningen, Groningen, The Netherlands
E-mail: M.P.Mobach@bdk.rug.nl

ABSTRACT
Within the systems movement most methodologies are applicable to various areas in the real world. These methodologies produce results with a high degree of generality useful to reflect upon the real world and improve our understanding of it. However, they mostly do provide the practice with limited information on details. Implementation of our conclusions may therefore be problematic. Following this complaint it may be useful to refresh our methodological tools in tune with specific real world problems. It is expected that such fine-tune may contribute to the effectiveness of the existing systems methodologies. This may involve a synthesis of paradigmatic differences and new research across scientific and professional disciplines. In this paper design question for a new organisational building are used in that particular way. It may help us to develop new tools, to foster learning processes, to synthesise hard and soft approaches in that area and which may finally contribute to an improved understanding of the real world and improved implementation of our conclusions.

Keywords: Architecture, Hard Systems, Management, Organisation, Soft Systems

1.0 Introduction

A serious weakness of systems science is that the findings seldom have any chance of implementation that sometimes relegates that our pronouncements have no consequence for the professional practice (Van Gigh 2001). We may therefore try to develop methodologies with an improved fine-tune with professional practices. As such are the professional practices of management and architecture, entwined in the design process of a building, a useful example to illustrate such possibilities. The manager seeking to reflect his organisational vision in the building such as the organisation of human activities and the architect trying to immerse himself in the user perspective and finding opportunities for his own specific architectural design ideas. Core problem situation is the transformation of fluid organisational concepts into more tangible concepts applicable for the design and construction of a new building.

The differences in properties of technical and social systems complicate this interdisciplinary design process. Whereas the technical system is basically fixed, is the social system basically fluid and kaleidoscopic in nature (Checkland and Holwell 1998). We would expect manager and architect to overcome this difference and to design both systems in close harmony and to aim at a fit of organisation and building in the design process (Mobach and Rogier 1995). However, both professions are supported by their own related but different design methodologies. Systems science, especially an interdisciplinary synthesis of hard and soft approaches on the subject still to be developed, may contribute to the methodological support of both professional practices, since human and technical design questions of construction will always emerge as an interdisciplinary interconnected system of hard and soft problems. But within systems science, two separate and contrastive traditions support human decision-making in the design of technical and social systems. Although some systems ideas of a synthesised framework are present in rudimentary form, an elaborated framework applicable for this specific design process does not yet exist.
2.0 Hard and Soft

Most systems comprise a cascade of elements and relations (Wilson 1984). The difference between hard and soft systems primarily relate to the change in elements and relations between them (Ulrich and Probst 1988). These properties make research into this area hard, since systems also comprise various states of elements and relations in a hierarchy of systems levels. The first (hard) tradition is concerned with complicated, mostly well definable, technical problems, which may comprise a large number and diversity of elements and relations. The hard approach has, for example, proven to be successful in the design of technical systems. The second (soft) tradition is concerned with ill-definable complex problem situations, not only comprising a large number and diversity of elements and relations, but also a flux of change in the elements and the relations between them. The soft approach has proven its success in the design of human activities. Following this distinction, for the moment the building is regarded as a technical system and the organisation as a human activity system.

The soft approach is used to design social systems. The two approaches lead to different concepts useful for management and architecture. In the hard tradition it is held that the relation between cause and effect can be visualised since constraints are firm and goals are unambiguous (Rosenhead 1989). A problem is ‘out there’ and can be solved in one best way, mostly resulting in a mathematically sophisticated solution. Such as the calculation of the efficiency or the profitability of a manufacturing process in organisations, can the strength of materials in architecture or the translation of a complicated architectural form into manufacturing data be calculated and incorporated in the best design solution within defined constraints. As such are the hard approaches an indispensable constituent for the interdisciplinary design questions of the managerial and architectural professions. In contrast, in the soft tradition it is argued that a problem is messy and created through the attribution of meaning to events (Checkland 1981, Checkland and Scholes 1990). The soft methodological framework supports clarification and intervention in messy problem situations. It helps to improve the understanding in these situations, to organise a debate, for example, about a design to improve organisational effectiveness, to change organisation culture or to transform such new organisational concepts into architectural forms, and it also helps to seek accommodations which make such changes possible. In this conception people learn from such problem situations rather than ‘just’ solve them (Argyris and Schön, 1978, Argyris 1992, Flood 1999, Schön, 1983, Senge 1990). In a process of appreciation they debate possible courses that may be followed and the relationships these courses will affect (Vickers 1965, 1983). In these courses people set standards or norms rather than goals. Vital is that the soft tradition allows different worldviews on the same events (Wilson 2001), evidently leading to different purposeful actions in practice. As such are the soft approaches also indispensable for the interdisciplinary design questions of the managerial and architectural professions. Consequently in a design process of a building, manager and architect both traditions to complete their task in practice. These professionals seek accommodations to unravel an interdisciplinary interconnected system of hard and soft problems and opportunities for an interdisciplinary synthesised design.

3.0 Management and Architecture

In management science the system methodologies are compartmentalised: hard methodologies for hard problems and soft methodologies for soft problems. Following this difference, organisational design can be either driven by the methodological rules to solve complicated but well-definable problems or by the rules to understand ill-definable complex problem situations and to learn a way to change the problem situation. Whereas the hard framework has a final stage: the optimal or best solution to the problem, is the soft framework a continuous cyclic learning process. In architectural science the applied methodological framework is mainly hard in nature with a strong orientation on means and ends (Broadbent and Ward 1969, Broadbent 1988, Van Loon 1998). This can be understood since the architectural design is, in
contrast with the agile organisation, eventually fixed in a construction. Especially this difference between fluid and fixed makes the interdisciplinary design very sophisticated and intriguing. Roughly, within the architectural domain it is held that design is a transformation process from specification into realisation of the best or optimal solution via the creation, assessment and selection of alternatives. Within the design process, however, methodological support for the softer parts can also be recognised, for example, methods related to intuition, creativity, vision, creation, and experience (Gero and Mahler 1993, Jones 1980, Lawson 1997). The soft systems approach is however relatively unknown.

4.0 The Gordian Knot

Formulated differences between hard and soft problems and between management and architectural sciences may have scientific importance but provide the professionals in practice with little support. Human and technical design questions of construction will always emerge as an interdisciplinary interconnected system of hard and soft problems ('The Gordian Knot'). Managers and architects have to find accommodations to unravel these problems and to find opportunities for an interdisciplinary synthesised design. It is yet however unclear where and how systems science could provide support in these situations.

4.1 The Interdisciplinary Interconnected Knots in Practice

In the interdisciplinary professional design practices, however, manager and architect need to unravel hard and soft problems in order to find design solutions for organisation and building. An interesting example of empirical connections between hard and soft is in the design of the architect Frank Gehry of the Guggenheim museum in Bilbao, the capital city of the Basque country. The design of the museum is a masterpiece of hard mathematical calculation through its combined material of glass, orthogonal limestone blocks, and curved and bent titanium panels. At the same time these calculations were the result of the soft people process between Thomas Krens (director of the New York Guggenheim museum and explorer of venues beyond its main building in New York), Frank Gehry, the Guggenheim foundation, and the Basques authorities. In this soft part of the design process various interests were explored and elaborated in hard materials design. Interests such as the creation of an institute contributing to the identity of the Guggenheim foundation, of a building to exhibit art, and of an intervention to master the violent image of the Basque country and to transform its capital into an international centre for culture, finance and tourism. The Guggenheim museum is an interesting practical example of the interconnectedness between hard and soft systems design and it can be expected that manager and architect did seek accommodations in order to synthesise technical and social systems design.

4.2 Problems with the Unravelling of Knots

Following the interconnectedness of hard and soft problems in the design process, it will be a sophisticated process to support. For example, the very meaning of emergence is that one can never in advance be sure which problem proves to be which. Simple problems can eventually prove to be very complex, vice versa. In addition, organisational problems make it hard for both professions to determine the current and desired state of the systems at hand, as well as to transform their assumptions about these systems into architectural forms and materials. For instance, differences between espoused theory and theory in use (Argyris and Schön 1978), and between intention, emergence and realisation (Mintzberg 1994) may seriously limit the possibilities to optimise the interdisciplinary interconnected design outcome, not to mention the possibilities to design the best solution. But also problems to set the time frame and the boundary for the designed entities (De Leeuw 2000), as well as problems to incorporate organisational dynamics in the design process itself have considerable impact. A methodological compartmentalisation does neither support science or the professional practice with this matter. Non-rigorous inquiry in this area throws manager and architect back upon intuition and their professional experience to complete the interdisciplinary synthesised design task. Management and architecture, both
in science and practice, would benefit from a synthesis of the two approaches rather than a focus on the differences between them.

4.3 Current Support for the Unravelling of Knots
Evidently, in the professional design practices of manager and architect both hard and soft systems approaches are needed. Especially the last ten years there has been a significant rise of meta-methodologies trying to connect both approaches (Deallenbach 1994, Flood and Jackson 1991a, 1991b, Jackson and Keys 1984, Jackson 2000, Mingers and Gill 1997, Van Gigch 1991). The most important approaches being the critical approach and the multi-methodological approach, which both can be seen as particular forms of methodological pluralism. The critical systems approach (Flood and Jackson 1991a, 1991b, Jackson and Keys 1984, Jackson 2000), accepts the place of both hard and soft and offers a framework to select a relevant approach and to support the best use. In this approach the embedded soft and hard approaches remain intact. The multi-methodological approach (Mingers and Gill 1997), combines more than one methodology, either in whole or part depending on the specific problem situation. Both methodological combinations seek to make a richer picture of the problem situation and to improve related human decision-making. However, current literature shows that a custom-made synthesis between hard and soft approaches, applicable to interdisciplinary synthesised design questions of manager and architect on the subject, does not yet exist.

5.0 Relevance
The relevance of the development of a new framework may be illuminated with its expected scientific and social benefits.

5.1 Scientific Relevance
New research may be regarded as a quest for relevant constituents for a new framework, with input from hard, soft and meta systems approaches, management and architectural sciences, and the professional practice of manager and architect (figure 1).

![Diagram](image)

Figure 1. The development of an interdisciplinary synthesised systems approach
The development of such framework elaborates on two important scientific problems. First, design literature on the subject shows that the managerial perspective is relatively isolated from the architectural, vice versa. Cross-fertilization may improve this specific design process and its related outcomes. Second,
systems thinking should confront the challenges posed by complexity and change through improving its interdisciplinarity and practical relevance. Systems science has a high level of generality encompassing the larger slices of the world (Van Gijch 2001). A start at design questions for management and architecture may therefore involve finding a delicate balance between specificity and generality. Following Van Gijch, we may therefore expect to increase our knowledge about design details which may hopefully also enrich our methodological systems tools and improve the effectiveness of systems research and the implementation of solutions to real-world problems.

5.2 Social Relevance

In 1995, in The Netherlands the new city hall and library of The Hague were completed after nine years of design and construction. The architect Richard Meier designed this immense building for the local authorities. The total cost for the city hall was around € 124 million. The use of the building revealed problems at some points. Within two years the organisation made an intervention to solve these problems: a reconstruction of well-over € 3 million. It is expected that at least part of this cost could have been avoided, but at the same time and in contrast, that other parts could never have been avoided. On one hand, for example, Meier did assume that the building should facilitate openness within the organisation and between the local authorities and the public. But after completion, problems were experienced with this constructed openness, resulting in problems with privacy, noise, and theft for the organisation members and the visitors, and resulting in costly reconstruction measures to solve these problems. On the other hand, such costs to improve and maintain the fit between organisation and building, and by doing so, minimise the tension between the fluid organisational form and the fixed architectural form, can never be completely avoided. At the moment, for example, the offices at the city hall are transformed into flexible working offices.

Modifications after completion of the building will always be necessary to some extent, but it is assumed that an interdisciplinary synthesised framework could improve the debate on the subject, the finding of accommodations, the transformation into an interdisciplinary synthesised design and may eventually reduce cost for society. Improvements in the design process may have considerable impact on cost reduction at the outcome, for instance, a decrease of interventions in the construction process or reconstructions after completion. The Dutch government buildings agency estimates that the cost for such a follow-up, including costs for reconstructions to process modified customer preferences and costs for maintenance, absorbs 5% of the total budget for buildings in their portfolio. Improvements in the design process may therefore lead to substantial benefit for society, for example, regarding the Dutch total production volume for organisation buildings (so-called utility buildings) at the public and the private sector of € 1.52 and € 6.34 billion respectively in 2000.

6.0 Conclusion

The interconnectedness between hard and soft systems on the subject has not yet been addressed. Well-over thirty years ago the first ideas of the soft approach have emerged from the dissatisfaction with the limitations of the hard approach. The hard approach has continued in its endeavour to model and describe the real world and has substantially improved its methods to study technical and even social systems. The soft approach has developed various methodologies of significant importance and has witnessed a rise of scientific literature, especially in management science. Although some systems ideas of a synthesised framework are present in rudimentary form, a synthesised systems approach for these interdisciplinary connections between management and architecture is still to be developed. Although separate parts of these issues have been addressed and elaborated in systems science, management science and architectural science, a synthesis of systems and disciplines on the subject in science and practice appears not to be present. Even though interdisciplinary research has gained rising attention in the systems
movement, literature on this specific scientific relation between management and architecture is rather exceptional (Aguilar 1973, Handler 1970). It is expected that the interconnectedness between hard and soft problems will be revealed remarkably clear in the interdisciplinary interconnected design process of an organisational building and that new research in this area will foster scientific progress on the subject. Such research should challenge the currently dominating hard and soft paradigms in systems science, as well as specifically in management science and architectural science. It should therefore develop a new framework and enable mutual connections between the two systems paradigms and the two scientific disciplines.

Over the last years, the differences between the hard and the soft tradition have been described extensively within the systems movement. Today, for example within one of the leading soft approaches, soft systems methodology, it is held that the hard approach is a special case within the soft framework; a relation of apples and fruit rather than of apples and pears (Checkland 1985). However, no elaborated methodological framework supports clarification and intervention in the interdisciplinary interconnected knots of hard and soft problems on the subject. But in the design practices, manager and architect do need to find accommodations to unravel these problem knots allowing opportunities for a synthesised design. In the design of a new building, manager and architect can rely on either hard or soft approaches combined with intuition and professional experience rather than on a robust interdisciplinary scientific framework capable of synthesising hard and soft design problems. We would therefore expect manager and architect to experience problems with an interdisciplinary synthesis in the design and we would also expect these problems to emerge in process and outcome of the design. It is yet unclear where and how connections between the hard and soft systems approaches would be meaningful for the purpose of management and architectural sciences and for both professional practices. New research should therefore investigate where and how a synthesis of the soft and the hard systems approaches may be appropriate for the interdisciplinary design of human and technical design questions of construction. Such research should therefore explore three main issues. These issues should all be relevant and applicable for the interdisciplinary interconnected design of a new building at the professional practices of manager and architect. Firstly, it should visualise the existing relevant hard and soft methodological frameworks from management science and architectural science on the subject. Secondly, it should develop and elaborate a lead for a new synthesised methodological systems framework for management science and architectural science. Thirdly, it should also, by doing so, allow the introduction of the soft framework in architectural science and stimulate de-compartmentalisation within the systems movement.

References